DIESEL AND GAS ENGINE PROGRESS

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JULY, 1961

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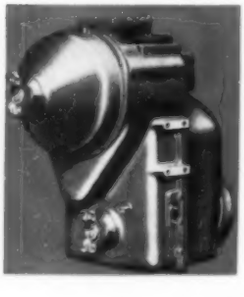
PROFIT • PERFORMANCE • DEPENDABILITY

ROCKWELL-STANDARD
BDB
FULL POWER SHIFT
TRANSMISSION

ROCKWELL-STANDARD
PLANETARY AXLES

Loaders and similar heavy-duty vehicles teamed with these components are "computer matched" for a winning performance. Optimum traction, acceleration and power utilization *assure faster work cycles with larger per hour profits.*



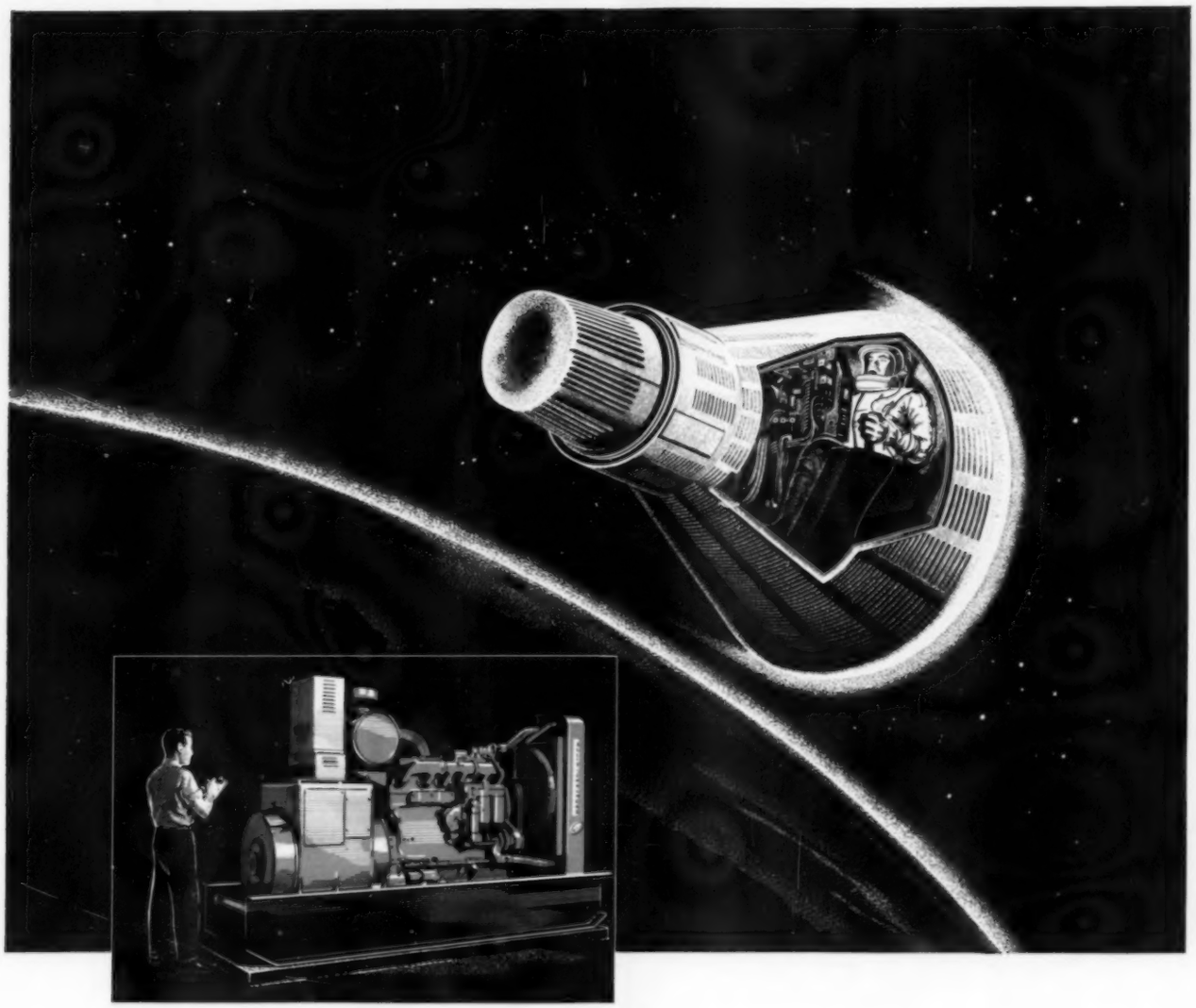
Rockwell-Standard type BDB Hydra-Drives transmission combines in one package the desirable features of a hydraulic torque converter and full power shift transmission with compact "built-in" drop box construction. Clean, rugged, four-speed countershaft design reduces maintenance costs. Built to last, it contains up to 35% fewer parts, is easier to understand and quicker to service.

Rockwell-Standard Planetary Axles assure dependable, rugged, efficiently designed units capable of maximum performance on any heavy duty operation. Exclusive features provide equal distribution of loading to all planetary gears—a minimum of maintenance—constant lubrication of all parts—and a full range of capacities in rigid and steering axles.

Another Product of...

ROCKWELL-STANDARD
CORPORATION

Transmission and Axle Division, Detroit 32, Michigan



ALLIS-CHALMERS DIESEL-ELECTRIC POWER

Vital link with our man in orbit

When our first Project Mercury Astronaut streaks into orbit, riding a spacecraft, he'll have vital ground support from Allis-Chalmers equipment . . . powering the most advanced communications network ever built. He'll be in touch through this space-age system with 17 stations extending around the globe at such places as Bermuda, Australia, Canton Island, and on picket ships at ocean locations. This network will track his 120-mile-high flight, and provide him with a dependable link with his earth-bound colleagues. Helping to power this global network will be 47 diesel engines with static-free generators, precision control and regulating equipment . . . all designed and built for Project Mercury* by Allis-Chalmers.

*Directed by the National Aeronautics and Space Administration, a Western Electric-led team of industrial contractors is providing the world-wide tracking and ground instrumentation system to support the Mercury project, this nation's initial manned space flight program. Station design and construction is the responsibility of Burns and Roe, Inc.

ALLIS-CHALMERS

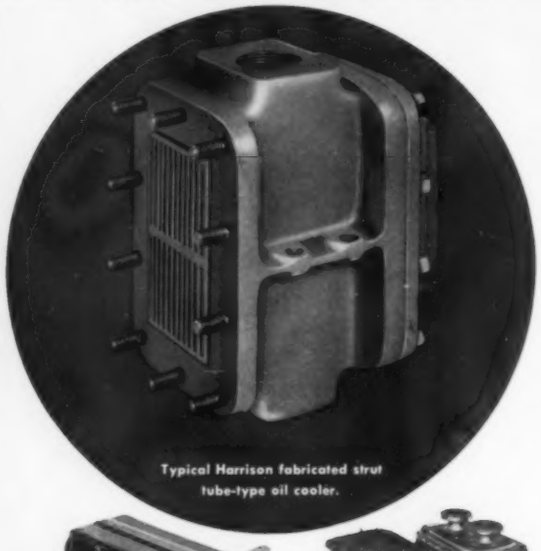
POWER **FOR A GROWING WORLD**

General Motors Reliability in Action...

SUPER ROADPACKER PACKS A COOL WALLOP!

DIESEL-POWERED ROADPACKER BEATS OUT ROAD BED . . . DEPENDS ON GM HARRISON FOR RELIABLE OIL COOLING!

Like a nervous centipede, Lima's Super Roadpacker beats the ground with up to 12 vibrating shoes. This ingenious tamper gets plenty of power from two GM Diesel engines —one furnishes forward propulsion and another drives two hydraulic pumps for the vibratory shoes—and both engines get efficient oil cooling from reliable Harrison heat exchangers. This reliability—"measurable excellence"—is built into all Harrison heat transfer products, and it makes them perform precisely as you wish for as long as expected. Harrison reliability is available in a wide range of basic types of heat transfer construction—a complete line of designs which assures the *right* heat exchanger for every application. To solve your temperature control problems most efficiently and economically, call in a Harrison Sales Engineer at the design stage.



Typical Harrison fabricated strut tube-type oil cooler.

Harrison heat exchangers are quality products of General Motors Research and Engineering.

Free For an informative 48-page brochure on the complete Harrison line . . . write to Department 902.

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AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

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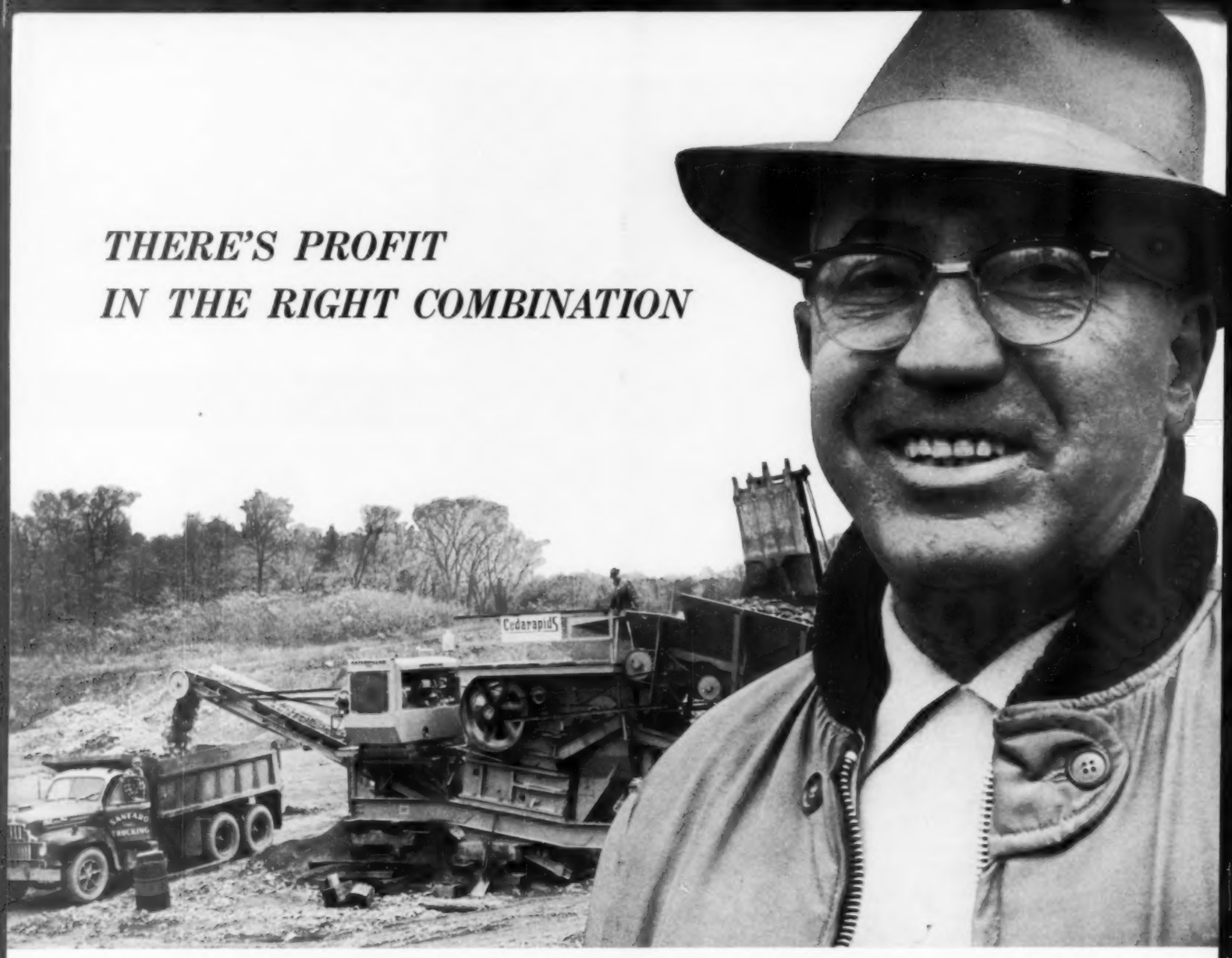
FRONT COVER ILLUSTRATION

Studebaker-Packard's entry into the diesel tractor field is shown on a test run prior to introduction. See page 33 for the story of these units powered by GM's 4-53 engine.

THERE'S PROFIT IN THE RIGHT COMBINATION



MODERN CAT DIESEL ENGINES AND CEDARAPIDS PORTABLE AGGREGATE PLANTS

"Cheaper by the ton." That's Mike Santaro's number one reason for powering this versatile Cedarapids Portable Primary Crusher with a Caterpillar D342 Diesel Engine. It lowers his aggregate costs, lets him sharpen his bidding pencil without cutting into sensible profit margins. Santaro's firm, Tarosan Construction Co., Inc., uses this mobile unit to crush bank-run gravel to a 3½ inch maximum for Syracuse, N.Y., area jobs.

Trim, modern Cat Diesels look and act as if they were designed specifically for portable crushers. It's not true, of course. These engines power many types of new equipment: trucks, draglines, shovels, locomotives, drill rigs, pumps, compressors, asphalt plants, workboats, road rollers, ditchers and earthmovers of every size.

Their trim lines make them the logical choice in *portable* crushing equipment where engine weight, size and horsepower are decisive factors. The D342 is rated an efficient 260 HP @ 1300 RPM (intermittent). It is turbocharged as an integral part of the engine's design for greater horsepower per pound and works efficiently on low-cost fuels.

Crushers churn up a lot of dust but Caterpillar's heavy-duty, dry-type air cleaner and pre-cleaner remove 99.8% of the air-borne dirt. Owners of Cat-powered Cedarapids crushers get maximum performance with minimum maintenance . . . and their equipment is backed by Cedarapids' worldwide dealer organization—the Cat Engine by more than 800 Caterpillar Dealers all over the free world.

You can take advantage of the combination of diesel economy and Caterpillar reliability in the equipment you manufacture. Write today for specifications on the entire Caterpillar Engine line.

CONSIDER THESE QUESTIONS IF YOU BUILD PRODUCTS REQUIRING ENGINE POWER

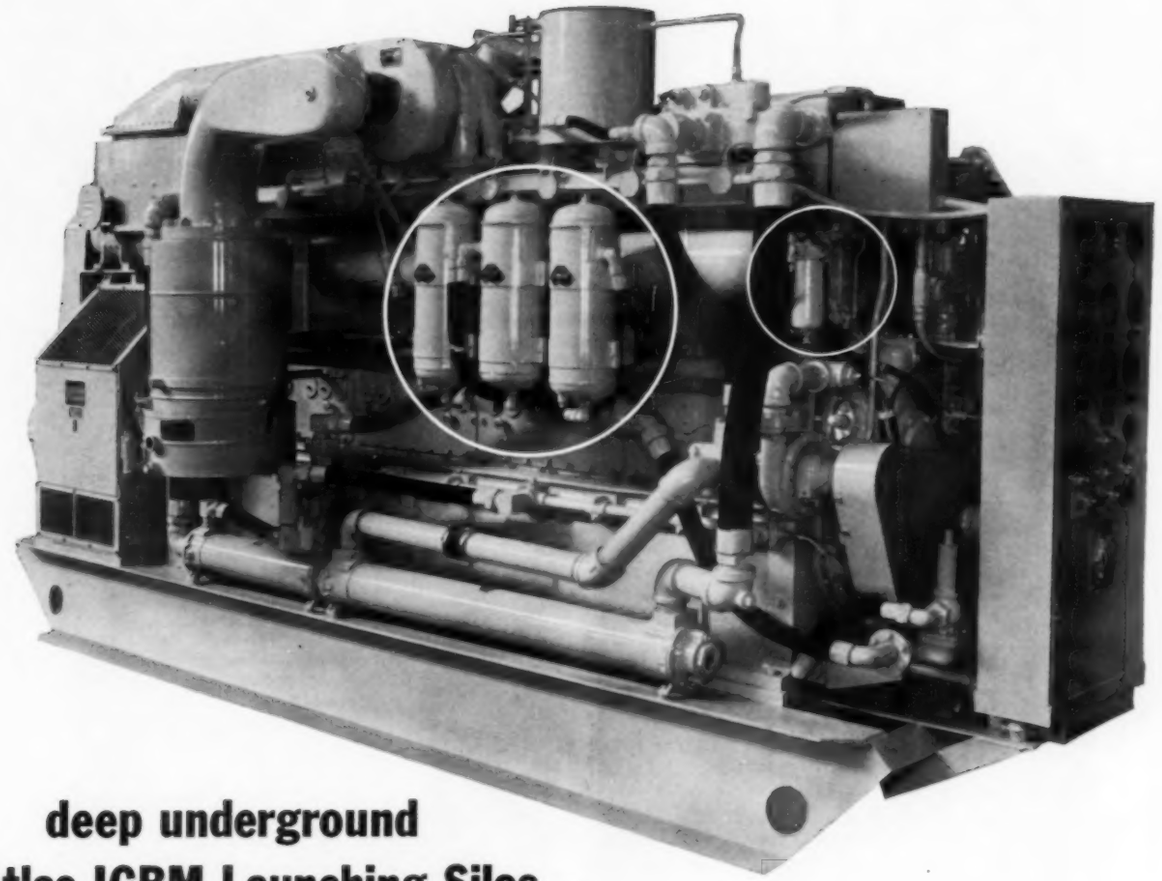
- Are components of your product easy to sell because of customer acceptance?
- Does the entire product (including the engine) receive outstanding parts and service backing?
- Does the product's engine offer a quality label that is so important to user satisfaction and repeat sales?
- Does the engine in your product have a reputation for high trade-in value?

Facts about Caterpillar. Caterpillar Engines have enjoyed a reputation of high quality for more than 30 years. 5000 Caterpillar Dealer field trucks in the U.S.A. alone can provide quick service when needed. Caterpillar Engines have a reputation for high trade-in value and low total cost of owning.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.



deep underground in Atlas ICBM Launching Silos...

CFC Fulflo Filters Help get UNINTERRUPTED POWER to Vital Computers and Guidance Systems.

Superior White diesel engine-generator sets will furnish ground support power for Atlas Missile sites across the country. Where dependable and precise power delivery is fundamental to the operation of complex computing and guidance mechanisms, high efficiency is required of every component. To meet the rigid specifications, CFC Fulflo Filters have been selected to protect the engine lube systems* on these compactly integrated diesel units.

Continuous clean oil is essential for efficient lubrication, better compression, less engine wear and maintenance. CFC Filters, each type with a proven performance record, combine a range of sizes and media for every diesel application . . . for lube, fuel and hydraulic oils, additive-type as well as straight mineral oils, on marine, transportation, construction and stationary engines. Operating conditions will dictate the right filter and compatible filter media from the complete selection of CFC equipment. Designed to cut engine wear to a minimum, each CFC filter type unites compact adaptable design with continuous efficient removal of damaging oil contaminants.

CFC FULFLO Filters incorporate depth-type wound fibre Honeycomb Filter Tubes of various controlled porosities; correct porosity selection will give optimum particle-size removal and filtration efficiency. In addition to various natural and synthetic fibers, other Fulflo media include pleated paper, sintered and woven metals and porous ceramics.

CFC HONAN-CRANE Filters have interchangeable fibre, pleated paper, fuller's earth or combinations of inert and adsorbent media.

CFC MICHIANA Filters with selected fiber media are designed for depth filtration in limited space conditions.

CFC lube filtration gives assured performance and maximum protection against wear and maintenance on all engine applications.

Write for technical literature to Department DP.

*CFC FULFLO Filters are also on the fuel lines.

COMMERCIAL FILTERS CORPORATION

Fulflo Honan-Crane Delpark Michiana

MELROSE 76, MASSACHUSETTS

PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

Big Steel-Hauling Fleet Proves Superiority of SPICER Transmissions...Universal Joints!

One of 80 steel-hauling GMC diesel tractors belonging to Hess Cartage Company, Detroit, all of which are equipped with Model 6853-C Spicer 5-speed synchronized transmissions and 1700 series universal joints.

Harry Murphy, Maintenance Superintendent for Hess Cartage Company, Detroit, for over 15 years, has charge of over 600 pieces of equipment, including 80 Spicer-equipped GMC tractors. "We need rugged, serviceable equipment in this business," says Mr. Murphy, "and Spicer components really fill the bill!"

With its giant fleet of truck-trailers hauling huge loads of steel* on stop-and-go runs throughout Michigan and Ohio, Hess Cartage Company, Detroit, is a formidable "testing laboratory" for components of all kinds.

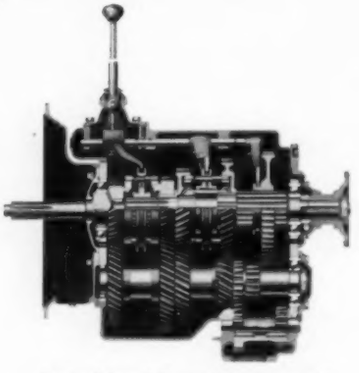
So, when Harry Murphy, Maintenance Superintendent for Hess, says "We've standardized on Spicer 5-speed transmissions on our fleet of 80 GMC diesel tractors," it means something.

"Our preventive maintenance program calls for overhauling our transmissions every 250,000 miles," Mr. Murphy points out. "Frequently, however, when we check our Spicer transmissions we find practically no bearing wear—and gears almost never have to be replaced!"

Hess's tractors are also ordered equipped with Spicer universal joints and propeller shafts. "Our experience with Spicer U-joints and shafts has been very good," Mr. Murphy reports. "We prefer them to any other make."

For further information, write Dana Corporation, Toledo 1, Ohio.

*As high as 88,000 pounds



Spicer 5-Speed Transmissions are available with or without overdrive.

Spicer Universal Joint Propeller Shafts come in a well-diversified range to fit any specific duty.

DANA Spicer **DANA CORPORATION**

Toledo 1, Ohio

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4D BROAD RANGE *TURBOCHARGERS*

with NEW DESIGN FIRSTS

* COMPLETE SERVICEABILITY
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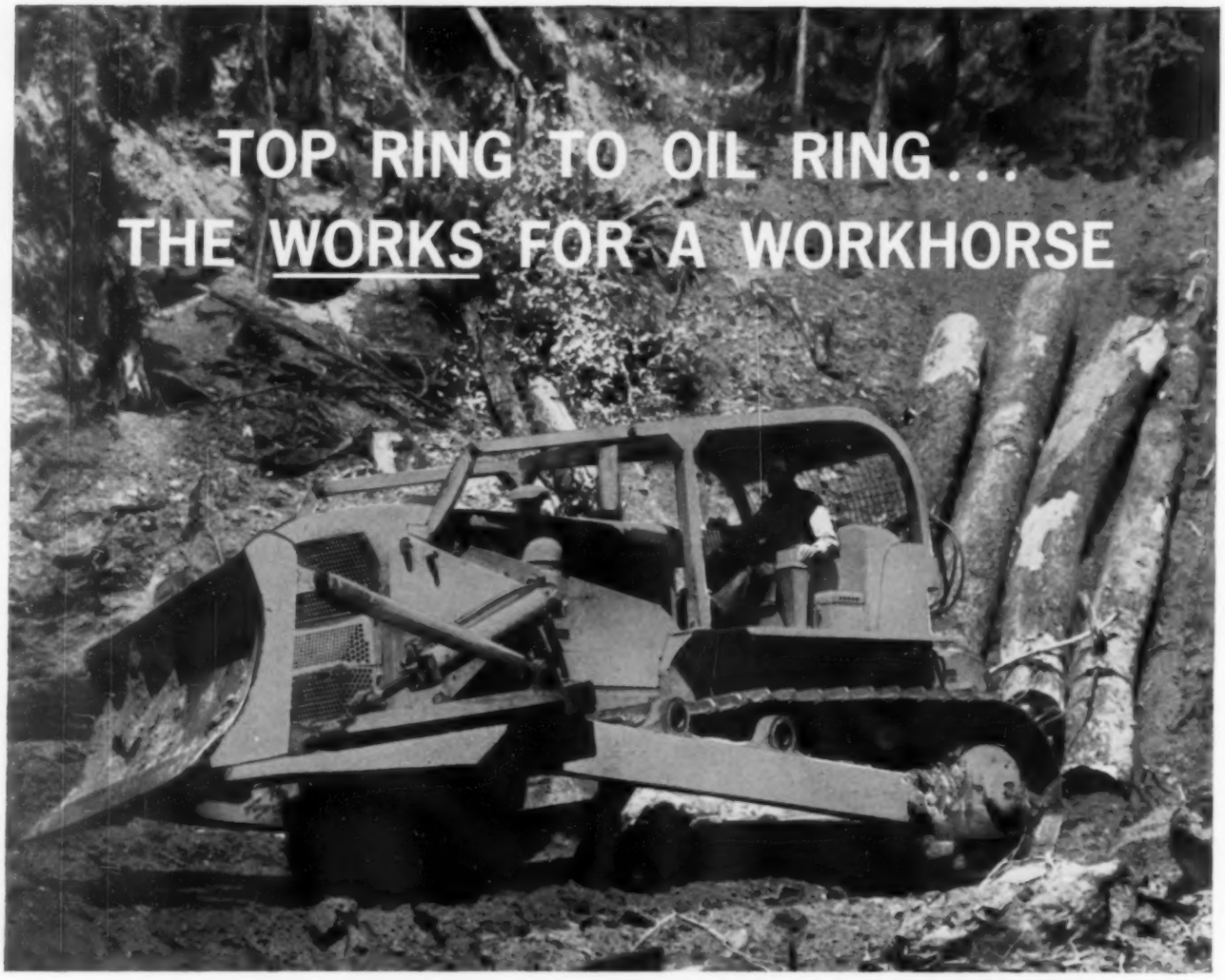


Koppers supplies packaged piston ring set for Caterpillar's husky D8 crawler Tractor

Extra stamina is demanded of every part of Caterpillar's massive D8 Tractor because it's built to push or pull the heaviest loads over the roughest terrain. This "something extra" is evident in the D8's powerful 235 HP turbocharged diesel engine—complete with packaged piston ring sets by Koppers.

Says Caterpillar: "The D8 Tractor is designed to excel; built to last. Take its 235 HP engine, for example. A 20% torque rise provides excellent lugging characteristics to meet critical loads. It's designed specifically for hard work, with dependability, economy and low maintenance. The Koppers rings we are using meet our requirements of quality and dependability."

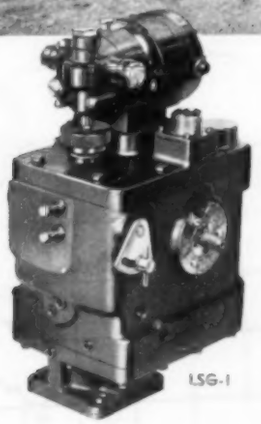
Write today for complete information to: KOPPERS COMPANY, INC., Piston and Sealing Ring Dept., 6202 Hamburg St., Baltimore 3, Md.

KOPPERS

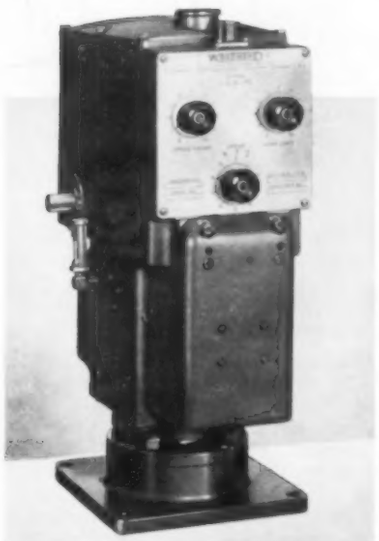
PISTON & SEALING RINGS

Engineered Products Sold with *Service*

That's a completely Koppers ring equipped piston you're looking at. From the precision lapped, chromium plated, high strength alloyed iron compression ring in its top groove to the chromium plated, conformable, spring loaded, ventilated oil ring in the bottom groove. This set-up guarantees fast break-in and longer life resulting in peak efficiency for Caterpillar's 235 HP diesel engine.



LSG-1



LSG-10

From Kwajalein to Greenland...

...WOODWARD LSG GOVERNORS keep U.S. Defenses on the alert!

Woodward LSG load and speed sensing Governors are meeting the critical power control requirements at U. S. defense installations both here and abroad. Diesel engines driving the generators that supply power for the electronic computers and data processing equipment at missile launching sites, SAGE bases, DEW and BMEW radar stations are under complete and dependable Woodward Governor Control. The LSG combines the rapid response of electric load sensing with the reliability of conventional speed governing — this in a unique arrangement assuring continued satisfactory performance even in the unlikely event of failure of the load sensing circuitry. Governor response is so rapid that, on most diesel engines, the fuel pumps are in a changed position before the next cylinder has received its charge of fuel.

The reliability and ease of operation that has characterized Woodward Governors for over 90 years can benefit your engine or turbine installation too. Write today for complete information about the new Woodward LSG Governors.

D-104

WOODWARD GOVERNOR COMPANY

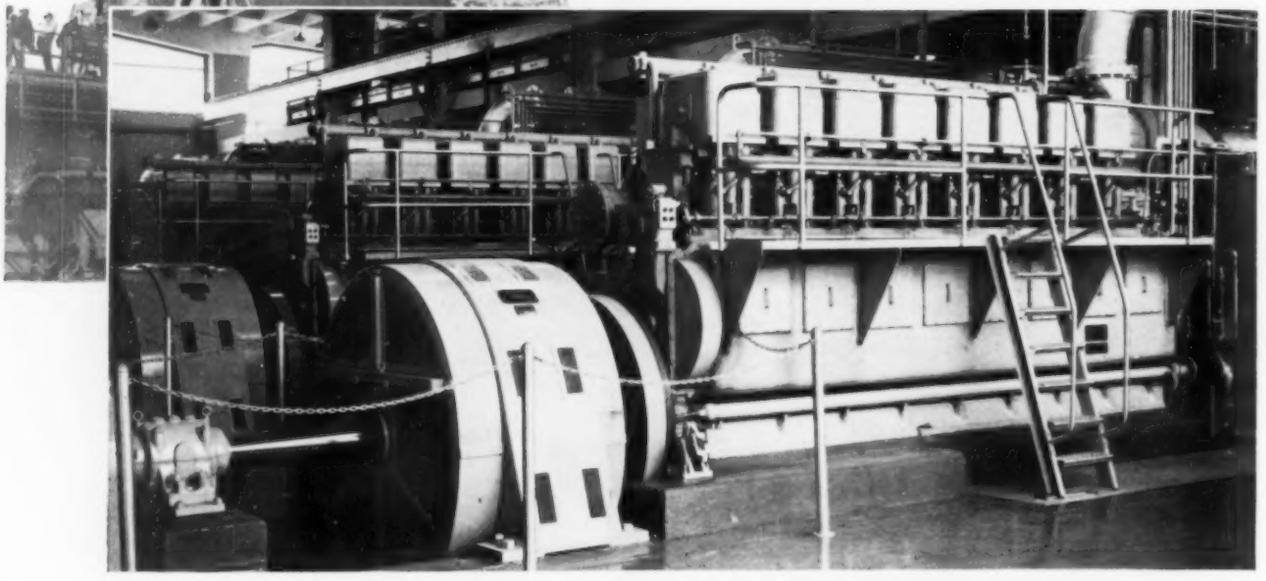
ROCKFORD, ILLINOIS

Fort Collins, Colorado • Schiphol, The Netherlands • Slough, England

WORLD'S OLDEST AND LARGEST MANUFACTURER OF HYDRAULIC GOVERNORS EXCLUSIVELY

ATLAS MISSILE COMPLEX

UNFAILING POWER SUPPLY assured with 6 NORDBERG DIESELS



The locale . . . an isolated point of land jutting into the Pacific Ocean near Los Angeles. Sprinkled through this brush-covered area is the incongruous evidence of the free world's first operating and training base for both intercontinental (ICBM) and intermediate range (IRBM) ballistic missiles. Suddenly, the area has sprouted towering gantries, huge concrete slabs, a busy air field, shops and offices, homes and barracks. This is Vandenberg Air Force Base, which has mushroomed into a populated, multi-billion-dollar aero-space age defense establishment.

The major mission of Vandenberg is to maintain an operational status with ICBM's. The base must be ready at a moment's notice to blast off its "birds" without fail. Vandenberg also serves as a training site for SAC ICBM crews to be deployed at bases throughout the country.

To insure an unfailing power supply, the Atlas Complex includes a modern power plant, comprised of six husky Nordberg turbocharged diesels rated 1344 hp at a conservative 450 rpm, giving the plant a total capacity of 8,064 hp. Each engine drives a 956 kw generator, and the total capacity of over 5700 kw gives the plant plenty of reserve capacity . . . a Nordberg diesel-electric generating plant that assures the world that no electric power failure will delay the gigantic Atlas guided missiles if they must soar into space in any emergency.

NORDBERG MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN

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P080-R

Power plant stretches diesel service -cuts maintenance costs- with AMERICAN D&G Oil No. 53

By C. F. KLENNER **Carl Klenner is a specialist at helping customers with their lubrication problems. A graduate of the Michigan College of Mining and Technology, he has been serving commercial customers since 1948. He also attended the Company's Sales Engineering School.**

* * *

At Roseau, Minnesota, the Municipal Power Plant uses Fairbanks Morse Diesel Engines for the generation of the city's electricity. And since 1946, lubricating oils supplied by our Company have played an important part in the excellent maintenance of this plant.

For example, diesel unit number two was overhauled in 1954 after six years' service. At our recommendation, AMERICAN D&G Oil No. 53 was put in the crankcase at that time. After 19,000 hours of oil service, the unit was taken down again. All rings were free, bearings and rings showed minimum wear, and there was negligible carbon on the piston skirts. With AMERICAN D&G Oil, this unit has averaged 4,584 horsepower-hours per gallon of oil.

For additional information about AMERICAN D&G Oil, contact your nearby American Oil Office.

American's C. F. Klenner checks performance reports with power plant superintendent Carl Grand.

Quick facts about
AMERICAN D&G Oil

- Made from highest quality solvent-refined stock.
- Contains additives which impart superior detergent-dispersant and anti-corrosion properties.
- Anti-foaming.
- Oxidation resistant.
- Recommended for
  —use with economy fuels.
  —extreme load service.
  —low temperature service.

AMERICAN OIL COMPANY
910 S. Michigan Ave., Chicago 80, Ill.

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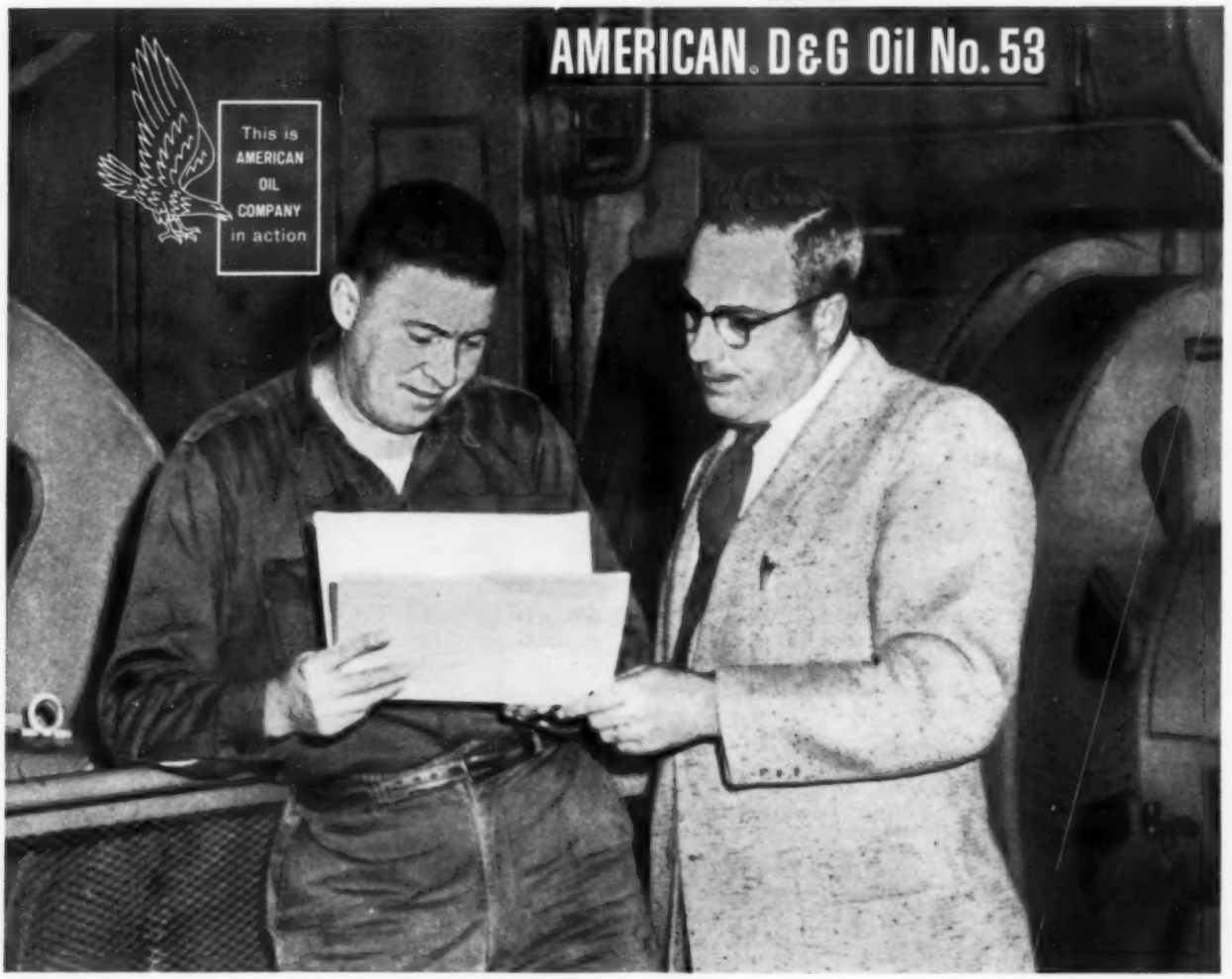
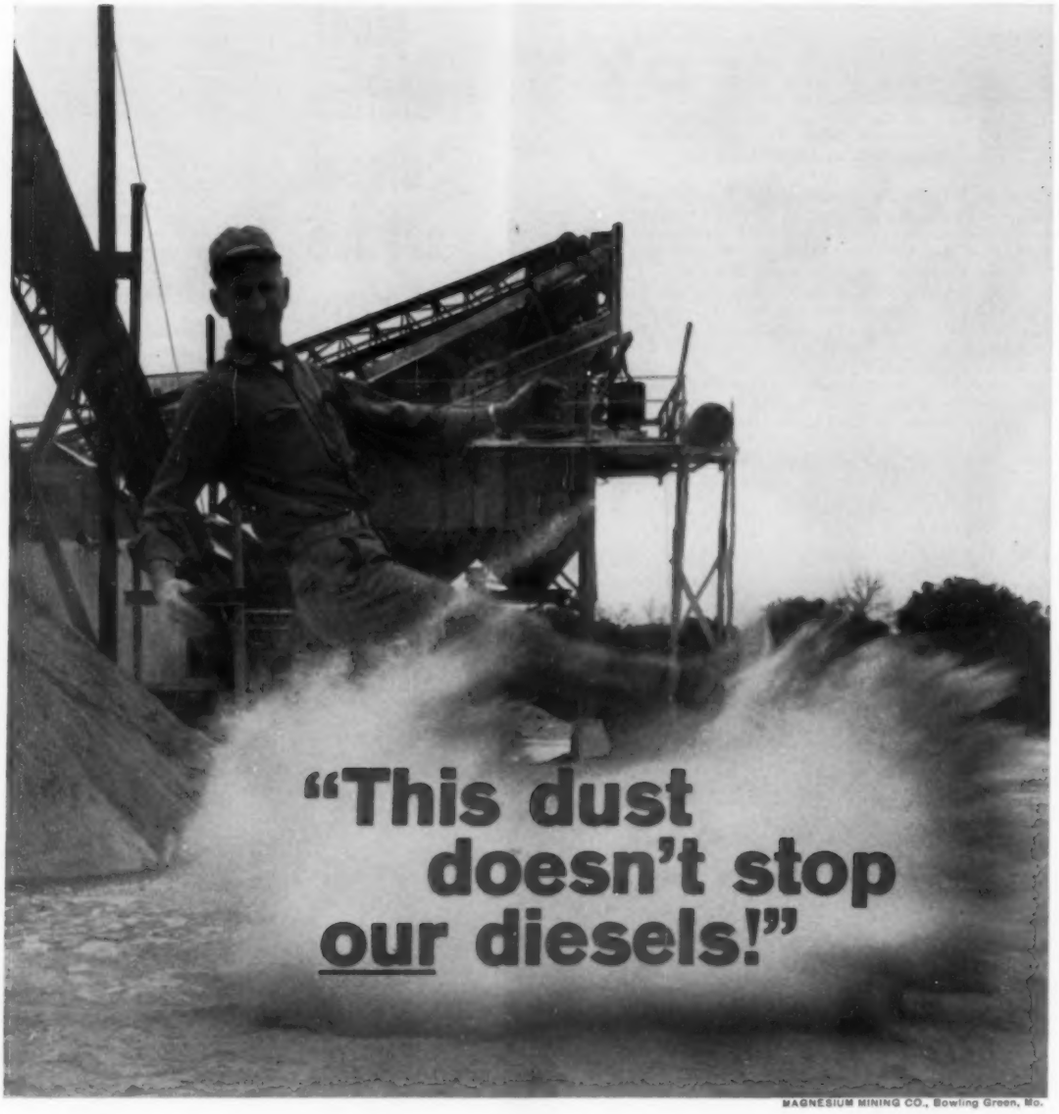




MAGNESIUM MINING CO., Bowling Green, Mo.

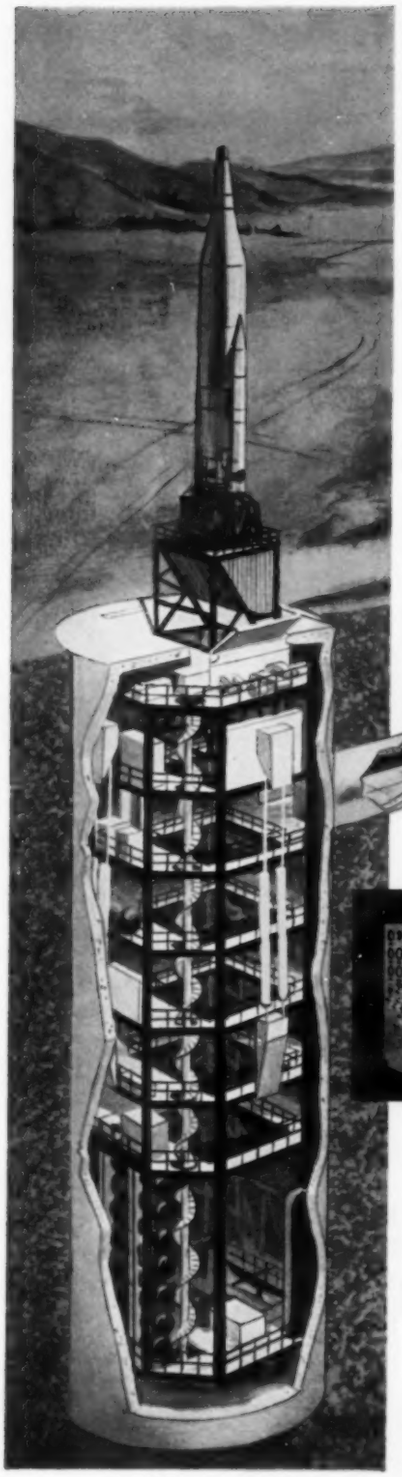
"We won't let it!" says Manager Tom Fitzgerald as he merrily kicks up a storm. "Our quarry is full of the stuff but all it does is make me wash my hair every night. Our equipment is in perfect condition. Why, some of our diesels have gone as long as 7 years *without one repair!* Cities Service is really doing an amazing job for us!"

Fitzgerald attributes the outstanding performance of his equipment to Cities Service DC-300 Oil. DC-300 is another quality product developed through Cities Service research. It prevents rust, sludge and deposits ... helps increase engine life and performance.

You can rely on Cities Service to keep your equipment in top shape under *any* condition. For more information, call your nearest Cities Service office or write: Cities Service Oil Company, 60 Wall Street, New York 5, New York.

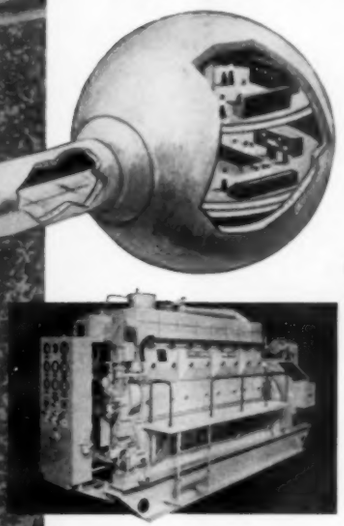
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS



WHITE SUPERIOR ENGINES selected for ATLAS launching sites!

At USAF Atlas launching sites throughout the United States, prime and standby power will be supplied by White Superior engines! The Army Corps of Engineers, Kansas City, Missouri, has purchased 149 eight-cylinder supercharged Model 40 Superiors, each driving a 500 KW generator. These engine-generator sets will produce precise frequency for operation of computers and other electronic equipment. Six of the 13 planned Atlas ICBM squadrons will feature underground silo-type launching sites. Here an additional task for the Superiors will be powering elevator machinery to lift the 120-ton ICBM's to ground level, after they have been fueled and checked out down under.



White Diesel

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

The contract for 149 Superiors highlights a growing and impressive list of Superior-powered U.S. defense installations. Included are the "Texas Towers," portions of "DEW" line and "SAGE" project, Eglin Gulf Test Range and other missile tracking ranges, and numerous launching sites for other types of missiles. Acceptance of Superior engines for these assignments is convincing evidence of their rugged dependability, trouble-free performance and economical fuel consumption. Superior engines—215 to 2150 HP or 150 to 1500 KW—will also meet your exact power requirements, including automatic, unattended or remote controlled operation. Write for complete information today!

USAF artist's conception of Atlas underground silo for launching missiles

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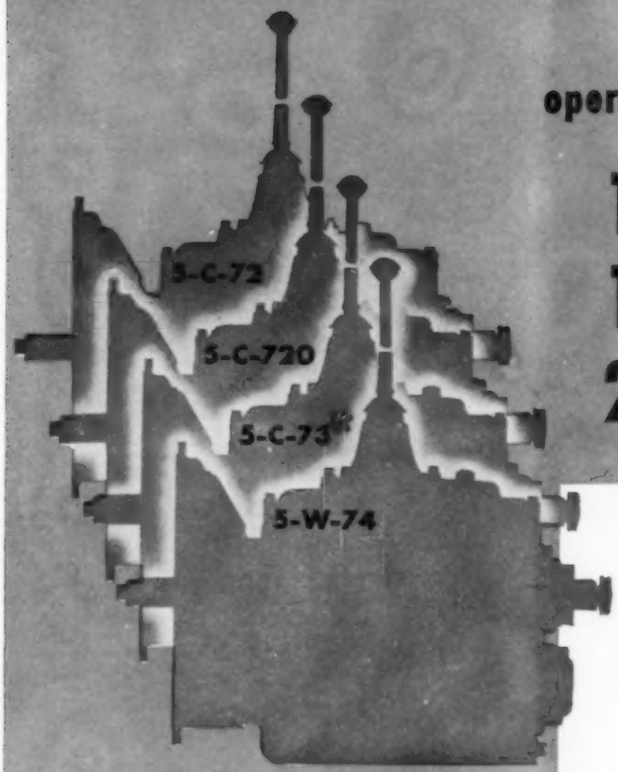

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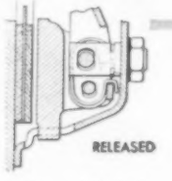

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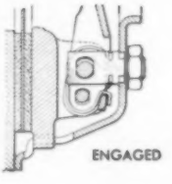

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DIVISION OF BORG-WARNER

WHY DIESELS TEAM WITH MISSILES

By M. D. WALHOOD and B. J. STEWART*
as told to James Joseph

192,520 kw of dieselization—power enough for a city of 320,000. That much diesel-electric output—one of history's largest diesel orders—has, within the past three years, been built into the U.S.'s nationwide system of ICBM missile bases, the majority of them the "hard," underground silo types. Silos which house such aerial mammoths as Atlas and Titan. And diesel-electric power is scheduled, too, for the upcoming Minuteman.

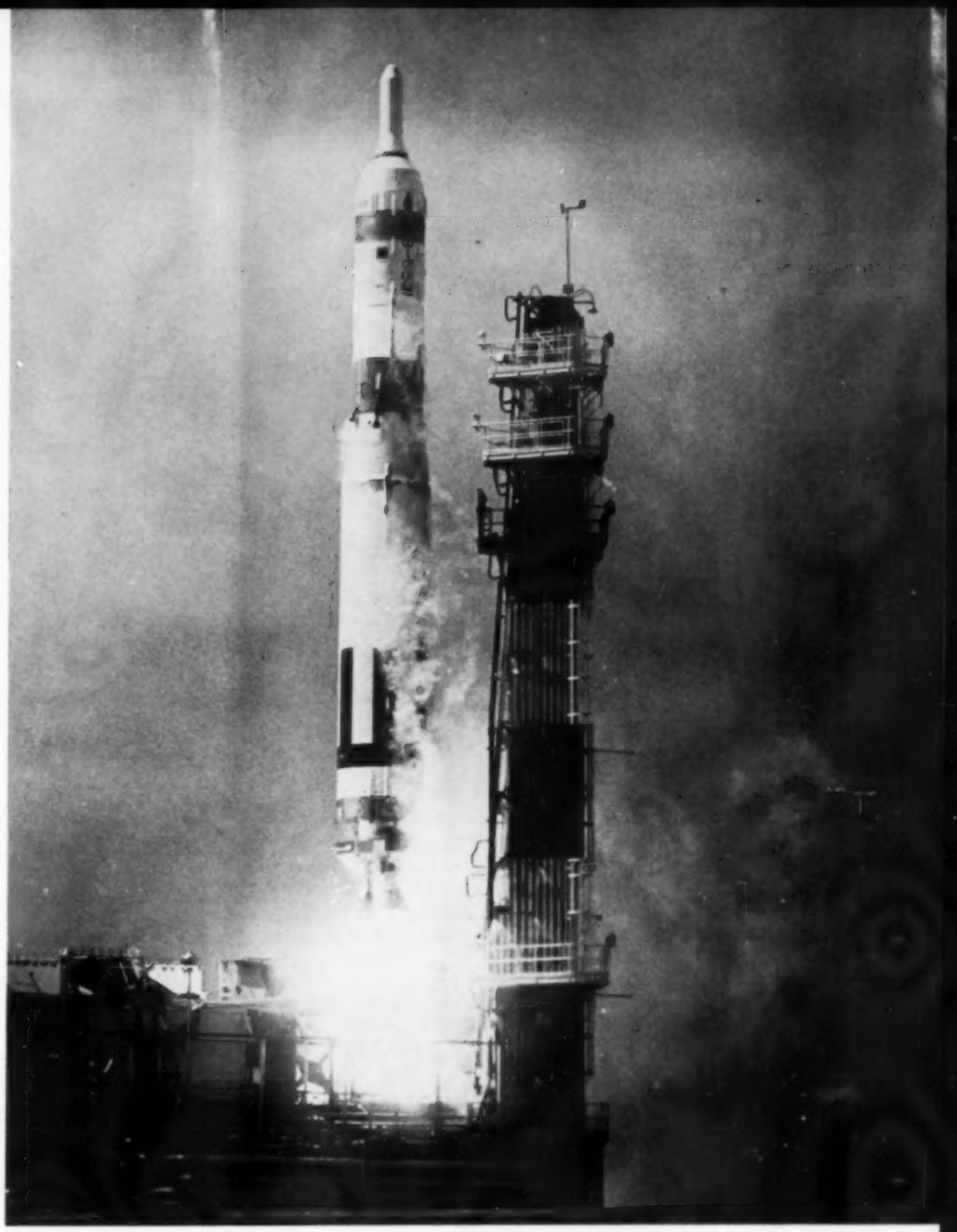
Those 192,520 kw? They represent fully 40 per cent of all the diesel prime power installed by the U.S. Air Force. Behind their engineered selection—by the Air Force Ballistic Missile Division (AFBMD), headquartered in Los Angeles—lies a diesel saga extraordinary:

The Air Force Ballistic Missile Division, segment of the Air Research and Development Command (ARDC), is charged with responsibility for system engineering and validation for ICBMS, including

M. D. Walhood

B. J. Stewart

the Atlas, Titan and Minuteman weapons—all intercontinental ballistic missiles, and backbone of the U.S.'s retaliatory prowess. The AFBMD was created in 1954 on a crash basis when it became evident that the USSR was capable of producing ICBMs . . . and as capable of launching them. Since then, the necessary research and development of ICBMs has been carried on concurrently with design and construction of ICBM missile launchers, in an intensive effort to close the gap between the Soviet capability and ours. The development of the ICBM launching facilities, from the first above ground configurations to the latest buried structures designed to withstand high overpressures, has required solution of problems never encountered in conventional structural design. The problem of designing the power plant portion of these facilities was no less difficult. AFBMD was faced with providing a power source for



Titan ICBM is one of U.S. series of ICBM rockets. Missile is designed to be stored in underground silos for protection from nuclear attack. Power demand for these installations and other missile complexes is met by diesel generating sets.

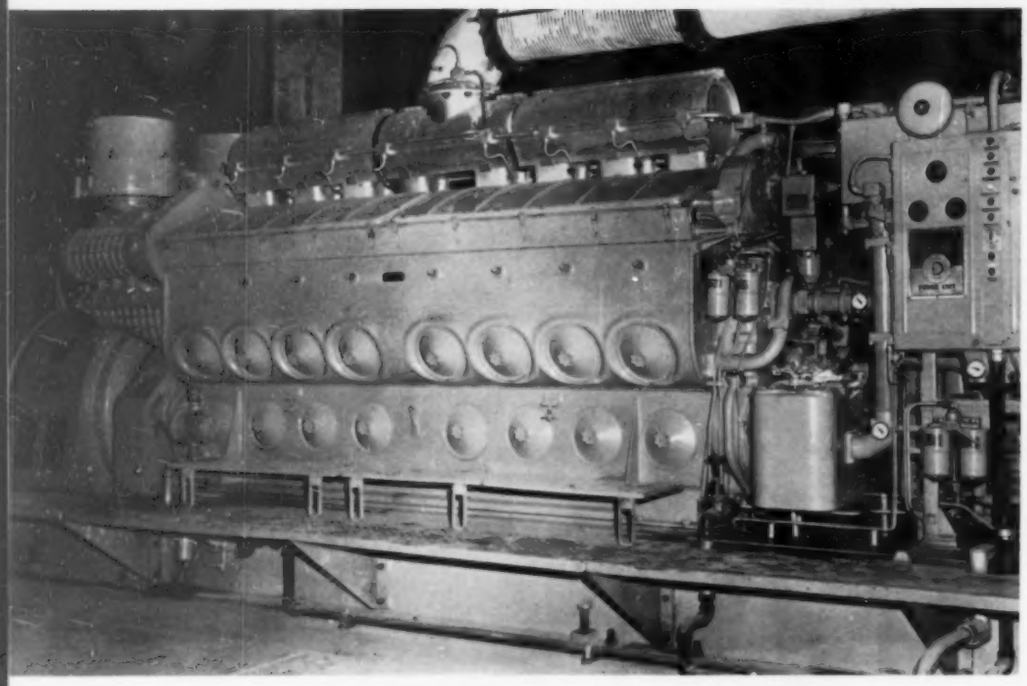
launchers which require extremely high quality power for sensitive and complex electronic equipment. The source had to be highly reliable, uninterruptable and self-contained within the launch complex. Consideration was given to operational factors: the fact that only the enemy can establish the time of the launching. And further, because a launching will occur once and only once, all men and equipment must be as near to 100 per cent reliable as possible, this to insure the launch within seconds of the need for retaliation. Exhaustive economic studies considered not only initial costs but also operating and maintenance costs.

Studied as possible power sources besides the diesel engine were nuclear power, fuel cells, batteries, gas turbines and various of these sources, combined with commercial power. When all factors were considered the conclusions were to use the old reliable work horse, the diesel engine, as the prime power mover for the sophisticated first generation (Atlas and Titan) Intercontinental Ballistic Missile Bases.

Selection of diesel engines as prime movers required solution of several unique problems not ordinarily required in power plant design:

1. Engines in the 1000 kw range, weighing 45,000 lbs., had either to be capable of absorbing extremely high accelerations, caused by nuclear blast-induced ground shock, or had to be mounted on shock mounts capable of reducing the acceleration to acceptable levels. In actual solution, combinations of the two alternatives were used. At one site, the engine blocks were cast from

**Myron D. Walhood is a mechanical engineer, B. J. Stewart an electrical engineer, with the Engineering Group, Air Force Ballistic Missile Division, Los Angeles*



GM 16-567 diesel engines drive Delco 1000 kw generators at Vandenberg AFB, Calif. Three of these units are installed at the base.

Worthington SDR-8 engines supply power at Lowry AFB missile installation. These engines turn Electric Machinery Co., 1000 kw generators.

Three of six Nordberg engines at Vandenberg AFB. Each engine is rated 1344 hp at 450 rpm at 2000 ft. altitude, turn 956 kw Ideal generators to provide power for Atlas ICBM complex at the base.

nodular iron, and mounted on coil springs. Smaller engine components were actually shock tested to prove their capability to function after a nuclear attack. On most sites, however, the engines are located on floors which are themselves designed to reduce acceleration to acceptable levels.

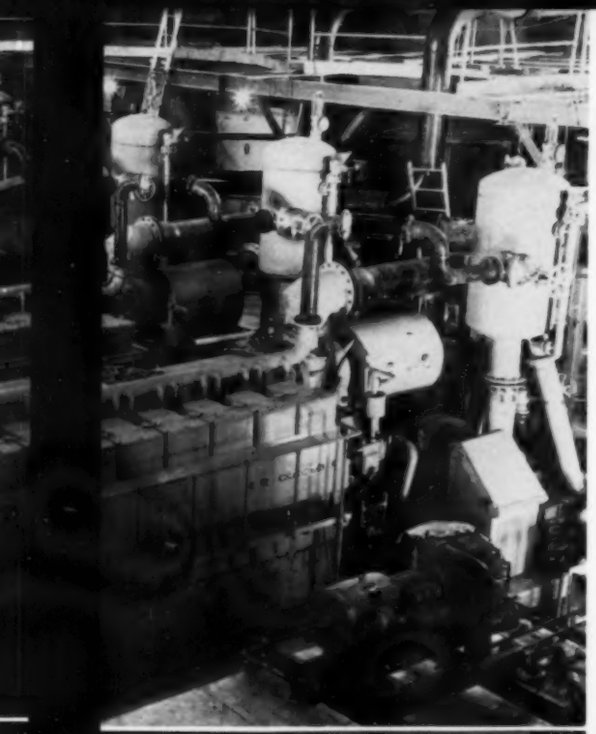
2. Heat rejected from the engines is utilized in every manner possible. The heating of water and incoming air, and humidity control, are keys to engine-heat usage. Unfortunately, the amount of heat produced by the engines rarely matches heating requirements. Generally, in fact, produced heat is far in excess of that required; the engines are below surface in a blast protected enclosure, surrounded by one of nature's best insulators, earth. Means of rejecting this excess heat to atmosphere had to be found which did not endanger the integrity of the protective enclosures.

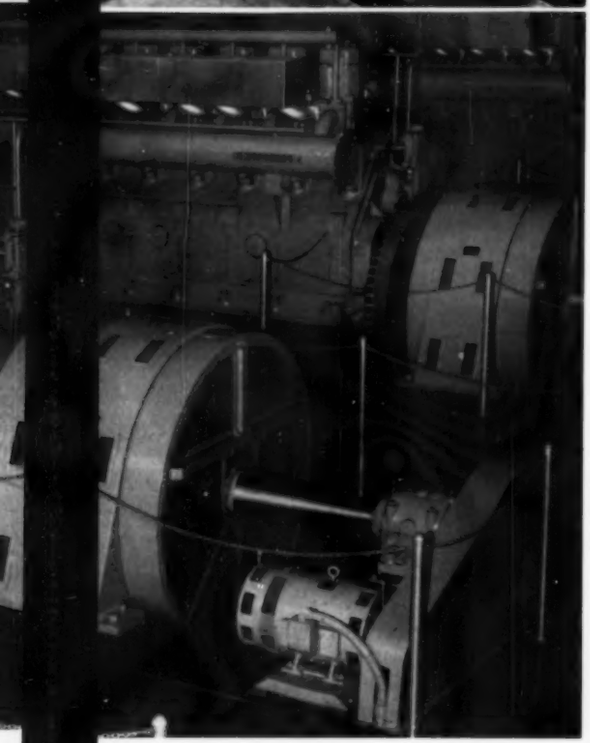
Diesel Generating Plants ICBM Bases

Base	*Unit Size kw*	*No. of Units Per Plant*	*Total No. of Units*	*Installed KW*	*Manufacturer Model*
Vandenberg Atlas	1000	6	6	6000	Nordberg FS 138
Vandenberg Titan	1000	3	3	3000	General Motors 16-567C
Warren I	1600	3	3	4800	Fairbanks-Morse 31A18
Warren II Offutt	500	3	18	9000	Chicago-Pneumatic 612 CPS
Fairchild Forbes	430	2	36	15,480	White Diesel 40-SX-8
Warren III	430	2	18	7740	Chicago-Pneumatic 612 CPS
Lowry	1000	4	24	24,000	Worthington SDR-8
Mt. Home, Ellsworth Larson, Beale	1000	4	48	48,000	Nordberg FS 138
Atlas Silo	500	2 except 1 unit in test facility.	149	74,500	White Diesel 40-SX-8
			TOTALS: 308 engines	192,520 kw	

3. Vapor Phase –high temperature cooling is used on some underground configurations, the generated steam providing heat throughout the launcher facility. Other locations require boilers to dissipate engine exhaust heat during peak heat loads. Some sites use cooling towers above ground which are expendable in case of a blast (cooling is then accomplished by the utilization of large underground reservoirs). Spray ponds are used on some of the other sites.

4. "Soft" sites–the above-ground type–have conventional cooling systems as dictated by economics. This includes cooling towers and radiators.





were: the relaxing of quality of power required as prime source; lower requirements for uninterruptable power, making it possible to carry this load with storage batteries; and, finally, a somewhat lower total power demand.

Total power demands for Titan II and Minuteman sites will be less because of the elimination both of high speed propellant loading systems, and high speed elevators (formerly needed to lift fueled missile from underground storage to the surface). Additionally, newer sites incorporate a simplification of checkout and support equipment.

A summary of diesel-engine driven generators purchased by AFBMD for installation in operational launch facilities is listed below with manufacturer and model number indicated. Procurement cost of the units ranged from $83 per kw to $224 per kw. Speed of the units vary from 277 rpm to 720 rpm. All were purchased through competitive bidding.

Diesel engine industry consultants were invaluable in basic powerhouse design and in drafting specifications which would provide competitive bidding, reliability and low price. Specifications contained standardization clauses to permit the purchase of additional units when required for identical application or for installation in the same geographical area.

Thus, at the abuilding U.S. missile program's "hard" launch sites, a growing family of ever-ready and reliable ICBMs team with diesel engines—just as ever-ready and equally reliable.

Composite List Of Principal Accessory Equipment Used At Diesel ICBM Bases*

Generators	Delco, Electric Machinery, Electric Products, Ideal, General Electric
Turbochargers	Elliott
Governors	Woodward
Fuel Oil Filters	Purolator, Fram, Nugent, Cuno
Lube Oil Filters	CFC Fulflo, Winslow, Hoffman Allen
Intake Air Filters	Air Maze, American
Exhaust Mufflers	Burgess Manning, Kittel
Lube Oil Coolers	Harrison, Ross, Davis, Yates-American
Air Compressors	Quincy, Ingerson-Rand, Gardner-Denver
Thermostatic Controls	Fulton-Sylphon, Amot
Pyrometers	Alnor
Vibration Isolators	Vibration Mountings
Fuel Injection Systems	Bendix, American Bosch, Robert Bosch
Lube Oil Centrifuges	Sharples, DeLaval
Vapor Phase Systems	Engineering Controls
Intercoolers	Young
Fuel Oil Pumps	Viking, Worthington
Heat Recovery Silencers	Engineering Controls
Water Pumps	Allis-Chalmers
Lube Oil Pumps	Tuthill
Tachometers	Barbour-Stockwell

*Listing Based on Information Supplied by Engine Builders

White Superior 40-SX-8 engine drives 500 kw GE generator for missile base power. This is view of installation at Atlas missile complex near Brainerd, Neb. To right is view of silo during construction and machinery installation.

5. AFBMD is continually exploring the feasibility of new power sources for operational launchers. The decision has been reached to use a combination of batteries, commercial power and diesel power for the Titan II and Minuteman operational launch facilities. Contracts for the first of these will be awarded during 1961.

The same factors used in the selection of power sources for the first launch facilities were also considered in determining the power source for the Titan II and Minuteman launch facilities. Factors that differ from the earlier bases and influenced the selection of a different power scheme

CP BOW THRUSTER SERVES USCG TENDER *COWSLIP*

KaMeWa Controllable Pitch Propeller Driven By GM 4-71 Diesel Increases Coast Guard Cutter's Maneuverability By Providing Thrust in Either Port or Starboard Direction

By CAPT. GILBERT R. SCHUMACHER*

ASSIGNED to duty in Portland, Maine, the U.S. Coast Guard Cutter *Cowslip's* primary duty is tending the aids to navigation in the navigable tidal waters between Rockland, Me., and the New Hampshire-Massachusetts state line. The size of aids in this area ranges from 15 ton, 9 ft. x 38 ft. lighted bell buoys to wooden spar buoys and third class can and nun buoys weighing in the order of 500 to 700 lbs. In addition, the *Cowslip* transports fuel, water, and supplies to all isolated light stations in her operating area.

This vessel (WAGL-277), like other buoy tenders, must be stopped or operated at very low speeds in shallow water near navigational hazards while servicing floating aids. Steerage way is usually lost and the vessel is left to the mercy of the prevailing winds and currents. The conning officer must maintain the ship's position and avoid the hazards by short, violent bursts of propeller action with maximum rudder angles. This control method is not entirely satisfactory since the vessel's actions are not always predictable and could rapidly jeopardize both the ship and the crew engaged in handling the heavy aid on deck or alongside.

A smoother, more positive way of controlling the ship's heading while operating at reduced speeds or stopped was needed. To provide this capability, the U.S. Coast Guard has installed on the *Cowslip* a KaMeWa controllable pitch bow thruster built by Bird-Johnson and driven by a GM series 4-71 diesel engine rated intermittent at 150 hp at 2100 rpm.

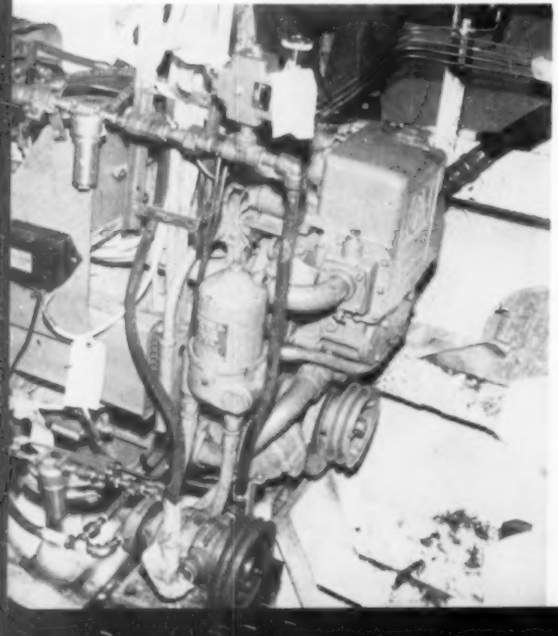
**Chief, Naval Engineering Division, U. S. Coast Guard*

The *Cowslip* was built in 1942 in Duluth and is presently manned by a crew of four commissioned officers, two warrant officers, and 44 enlisted men. The vessel has a length overall of 180 ft., a beam of 37 ft., full-load draft of 12 ft. 8 in., and a full-load displacement of 1026 tons. Hull is all-welded construction and is designed for ice breaking.

The vessel's propeller is five bladed. The tail shaft is supported in an oil filled stern tube by two roller bearings, and is directly coupled to the single bearing, 1000 hp, 500 volt dc, 170/208 rpm, Westinghouse motor. The motor may be connected in a series loop with either or both of two 410 kw, 250 volt dc, 600 rpm Westinghouse generators. Each generator is directly connected to a Cooper-Bessemer GN-8 diesel engine rated at 600 hp at 600 rpm. Propulsion control is on the bridge with remote controls on each wing.

The bow thruster unit is simply a propeller mounted athwartship within a transverse tunnel located forward of the vessel's center of rotation. Our installation uses a reversible pitch propeller to provide thrust in either the port or starboard direction. The sideways thrust pushes the ship's bow around in the direction desired without advancing the ship. Thus, ship control at low speeds or stopped is achieved. The KaMeWa bow thruster unit on the *Cowslip* is comprised of a tunnel assembly, a control cabinet, a diesel engine prime mover, the hydraulic and lubricating oil systems, and the control system.

The tunnel assembly is comprised of a 45 in. outside diameter tunnel with a wall thickness of 1 in. that houses and supports a pod in each end of the tunnel. Each pod is supported in the tunnel by three watertight struts approximately 120° apart. The pods then support the bevel gearing, controllable pitch propeller and pitch actuating mechanism. The tunnel assembly is welded in place between two outer tunnel sections that are welded and faired into the vessel's shell plating. The propeller is driven by right angle gearing housed within the pod in the port side of the tunnel. This pod serves as a support for the pinion bearing and thrust bearing. The pod in the starboard end of the tunnel supports the pitch actuation mechanism. The propeller hub assembly is bolted between two shafts that are supported by the pod bearings at each end of the tunnel.



Starboard side of GM 4-71 diesel which is direct connected to propeller drive shaft by flexible coupling. Hydraulic pump for pitch actuation is belt driven. Diesel is rated 150 hp at 2100 rpm.

The control cabinet, located adjacent to the tunnel, contains the air actuator cylinder, servo valve for setting pitch, follow-up mechanism for determining when the desired amount of pitch has been reached, pitch indicator transmitter and pitch over-ride for load control. An air signal sent from the bridge control console is received by the actuator cylinder and its motion is transferred to the servo valve through a yielding rod and control handle. Initial displacement of the control handle displaces the spool of the servo valve to permit the flow of hydraulic oil to the proper side of the pitch actuation piston to accomplish the desired pitch change. As the pitch changes, the control rod is moved by the follow-up linkage in proportion to the pitch change and returns the servo valve to its holding position when the desired pitch setting is reached. The pitch indicator transmitter receives its signal from the follow-up linkage and transmits an air pressure signal proportional to the pitch setting to an indicator in the wheelhouse, thereby giving an indication of the pitch setting. In the event the pitch setting represents an overload on the diesel engine, hydraulic oil is supplied to the pitch actuating mechanism and reduces pitch until the overload is removed. If the cause of the overload is removed, the pitch will return to its initial position.

The prime mover used to drive the propeller is a General Motors series 4-71 diesel engine. The engine's intermittent rating is 150 hp at 2100 rpm. and the continuous rating is 101 hp at 1800 rpm. The engine is connected to the propeller drive shaft by a flexible coupling. A reverse-reduction gear was not needed in this application since thrust reversal is accomplished by varying the propeller pitch and the speed reduction is accomplished in the bevel gearing; however, a manually operated disconnect clutch is provided with the unit as a protective feature.

Hydraulic oil for pitch actuation and lubricating oil for the bevel gearing and associated bearings is provided by tandem pumps driven from a

common shaft. The pump shaft is belt driven from the power takeoff on the forward end of the diesel engine. The pod in the port end of the tunnel serves as a sump for the lubricating oil circuit. The lube pump takes suction from the bottom of this sump and discharges through a full flow filter back to the sump. The pinion support bearings are lubricated by the discharge oil. The gear, pinion and thrust bearing are dip lubricated. The hydraulic pump takes suction from an oil tank. The pump discharges through a full flow filter and then to the servo valve located in the control cabinet. During a pitch change the servo valve directs the oil to one side or other of the pitch actuation piston and then back to the tank.

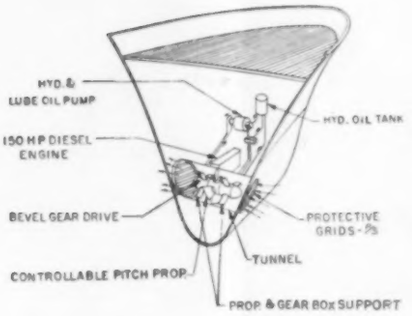
The primary control of engine speed and pitch is pneumatic. There is an auxiliary electric system for starting and stopping the engine, control of the Kim-Hotstart engine pre-heater and warning light and alarm circuits. Normal control of the bow thruster unit is from the main console located within the bridge or from the two mechanically connected wing slave stands located on the bridge wings. Movement of either of the three handles rotates a control shaft within the main console. Two cams are mounted on this shaft, each operating a pneumatic transmitter. One transmitter is connected to the pitch actuating cylinder and the second transmitter is connected to an engine throttle positioner. Three detents and two stops are provided to limit control handle travel. The mid-position detent corresponds to a zero thrust engine idle position. The detent to either port or starboard corresponding to seven-tenths of the handle travel represents the continuous load rating of the engine and the corresponding thrust. Movement of the handle beyond this detent to the stop represents the intermittent load rating and the corresponding thrust.

As the control handle is rotated to either port or starboard a pressure signal is sent to the pitch actuator cylinder and a second signal is simultaneously sent to the air operated throttle positioner on the engine. This positioner is connected to the throttle linkage and adjusts the throttle to the desired engine speed.

Instrumentation on the top of the KaMeWa main control console is comprised of the following: a. a pitch indicator that indicates percentage of port and starboard pitch as percentage of the maximum obtainable pitch; b. an engine speed tachometer; c. an engine start button; d. an engine stop button; e. an engine pre-heater switch; f. an engine lubricating oil low pressure alarm light; g. an engine jacket water high temperature alarm light; and h. a gear lubricating oil low pressure alarm light.

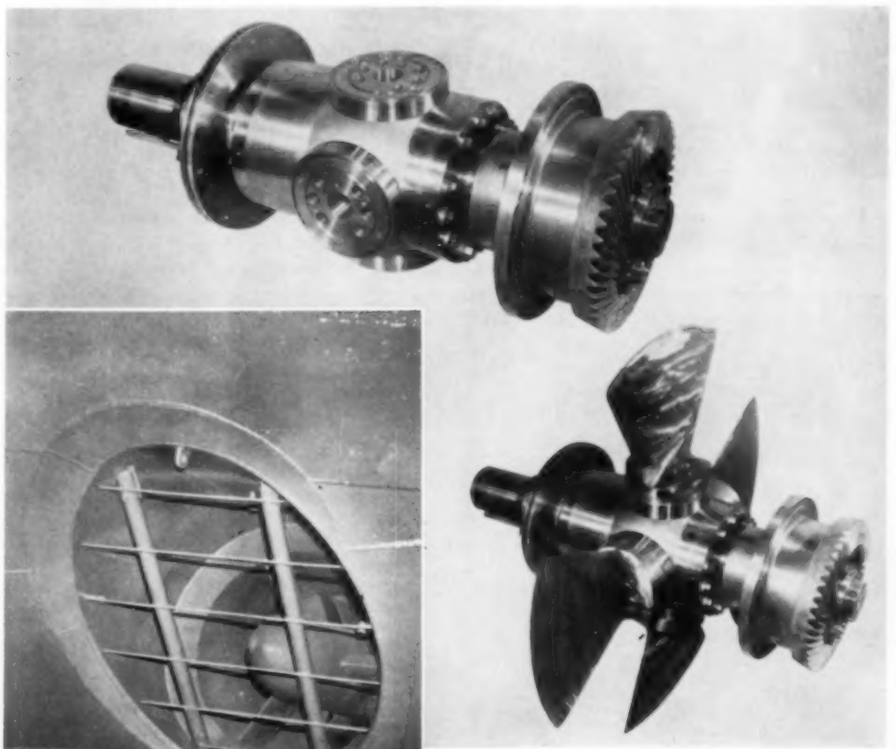
The bow thruster produces approximately 3300 lbs. of thrust as measured by dynamometers. The *Cowslip* can be pivoted 360° in approximately 8 minutes with winds up to 30 knots. Although the tunnel presents a discontinuity in the underwater body hull form, the vessel's top speed is unaffected. The installation has already proven the feasibility of using bow thrusters on buoy tenders and plans are underway to increase the unit's power to provide approximately 6000 lbs. of thrust.

BOW THRUSTER UNIT



Drawing of KaMeWa Bow thruster installation in USCG *Cowslip*.

Tunnel assembly being lowered for installation. Note tube is upside down at this point.



Immediate right is view of tunnel installed. To top and far right is KaMeWa tunnel assembly as built by Bird-Johnson. Thrust reversal is accomplished by varying propeller pitch and speed reduction by bevel gearing.

UD 236 drives a sand and gravel pump for Cheney Gravel Co., Holt, Mich. Pump is driven through 5-belt V-belt drive, takes waste sand out of portable washer at rate of 30 tons/hr.

Hough TD-80 Paymover tractor powered by UD 282 engine is self-contained unit for aircraft spotting and positioning. TD-80 tractor has power steering, power brakes and automatic transmission.

16 irrigation pumps, all powered by UD 282 diesels, are used on Sam Hamburg ranch, Dos Palos, Calif. Each pump unit provides water to a pipe system one-half mile long, and containing from 300-360 spray nozzles. Output is 1000-1200 gpm.

New Engines at Work

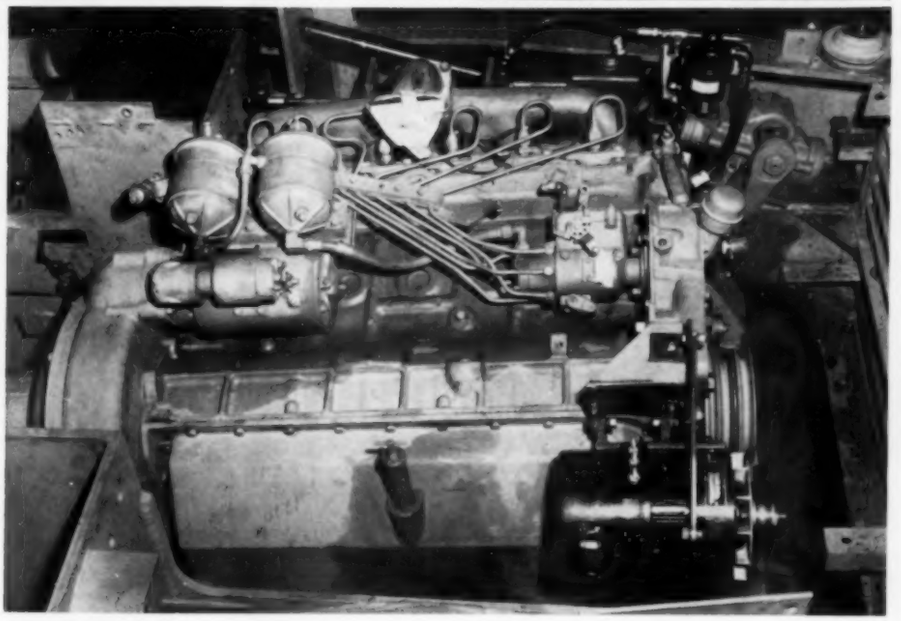
OUT IN THE FIELD WITH A PAIR OF I-H DIESELS

IN late 1958 DIESEL AND GAS ENGINE PROGRESS announced to the industry two new International-Harvester diesels—the UD 236 and the UD 282. These engines fit well into International's middle horsepower range and rated 75 and 90 hp respectively at 2400 rpm, they have moved in two short years near the top of the company's best seller list. The engines marked two important "firsts" in the International line: 1) they were direct-starting diesels and, 2), they were interchangeable with carbureted engines. Later International removed the sleeves from the 236 and 282 and, with other design modifications, come up with the D-252 and D-301. Carbureted versions of these two engines are also offered.

Consistent with our editorial policy of covering new engines at work, in this article we take you out into the field for a look at some of the varying applications of these diesel engines. For your reference, the UD 236 is a "square" engine with a bore and stroke of $3\frac{11}{16}$ in. for displacement of 236 cu. in. The UD 282 has the same $3\frac{11}{16}$ in. bore but a longer stroke of 4.39 in. gives it a displacement of 282 cu. in. The engines have a pre-combustion chamber and are fitted with a glow plug for each pre-cup. They are of valve-in-head design and have replaceable cylinder liners, counterbalanced crankshafts and gear driven induction hardened camshafts. The fuel injection system is simple and accessible with automatic advance for good fuel economy. Injection nozzles are of the single orifice type with 1600 psi opening pressure and a Roosa Master distributor type pump is used.

The UD 236 and UD 282, as complete power units with clutch takeoff, have respective weights of 1410 and 1460 lbs. Both engines are available with extended shafts and outboard bearings where wide faced, small diameter pulleys must be used to obtain satisfactory speeds for driven machinery or where more than one pulley is necessary.

Gradall hydraulic digger with ½ yd. bucket is used by Shelby County (Tenn.) Commission to aid installation of 36 in. sewer. Hydraulic pump on this model M2460 unit is driven by UD 282 diesel through 1.47:1 speed reducer.



UD 282 diesel in Hough Paymover (see above) is special horizontal installation to keep unit profile low for passage under jet aircraft wings. Note Roosa Master fuel pump, Leece-Neville alternator.

Contractor for Elmhurst, Ill., sewage plant utilizes UD 282 to drive pump which passes raw sewage directly into diversion box while main pump is bypassed for installation of new sewage grinder and grit collector chamber. Pumping rate is 3000 gpm.

FLEET MODERNIZATION PAYS FIRM AN EXTRA DIVIDEND

Higher Work Capacity of New Diesel Tractors Allows Hayes Freight Lines to Replace 111 Older Tractors With Only 100 New GMC Cab-Over-Engine Units With 6V-71 Engines

AN extensive fleet modernization program paid an immediate and extra dividend to a mid-West trucking firm. A study of new engine features, and higher power available along with new, lighter cabs and components showed officials of Hayes Freight Lines, Inc., that 100 new tractors could perform more efficiently than 111 of the older models. The firm replaced its older transport equipment in mid-1960 with 100 GMC model DF-7000 tractors with V-6 engines. A subsidiary of McLean Trucking Co., Hayes is operated as a division of that company. While the operating headquarters of the Hayes Division are in Indianapolis, the general offices of McLean Trucking (including the Hayes Division) are in Winston-Salem, N.C. This is a common carrier fleet, hauling general commodities.

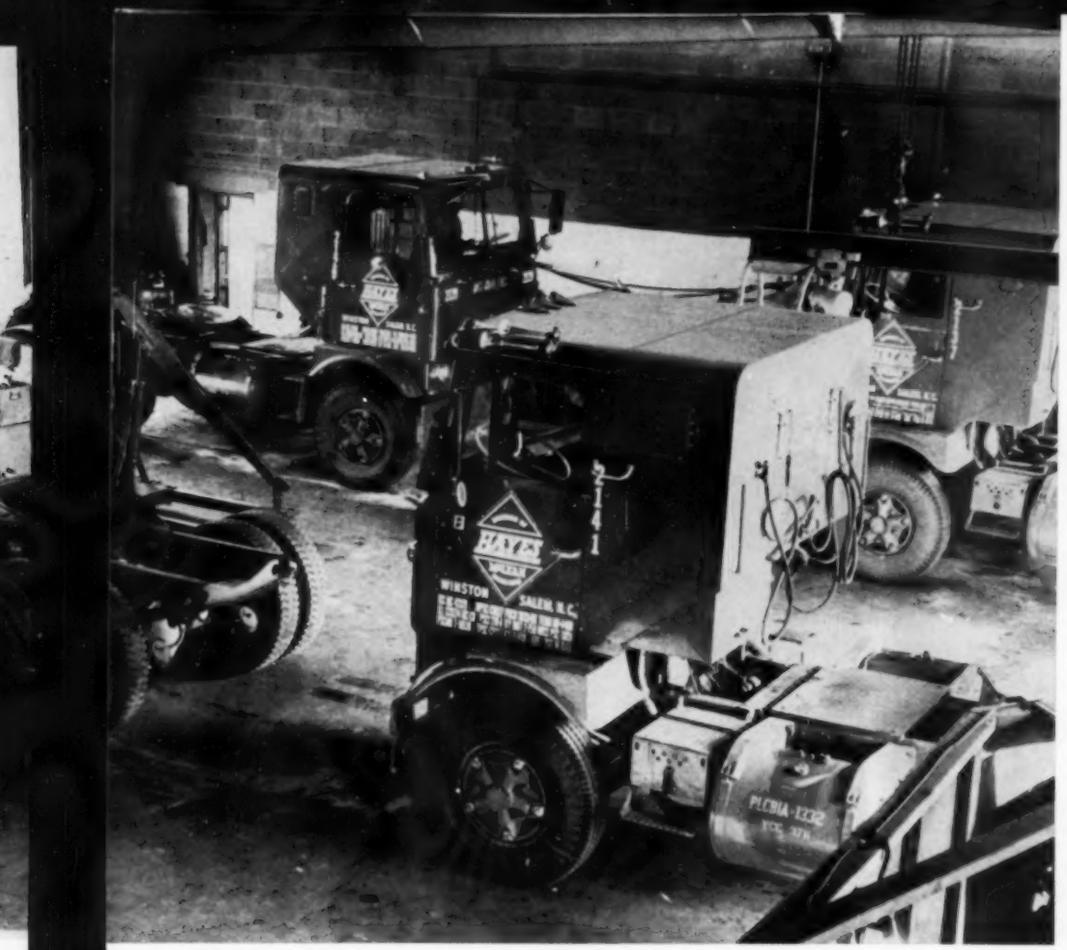
During the first six months of operation, the new fleet units accumulated an experience of over 4-million miles over the highways of its territory. This area is bounded on the north by Chicago, Detroit and Cleveland; on the south by Nashville, Memphis and Humboldt, Tenn.; on the west by St. Louis and on the east by Pittsburgh, Washington, Richmond and Baltimore.

Trailer units vary from 33 to 40 ft. lengths, depending on the type of loads to be carried, as well as the state laws in which the operations are to be conducted. The entire fleet operating on the common carrier schedule, includes 124 tractors, of which there are 100 of the GMC 6V-71s, 15 SE 6-71s, which are GMC six-in-line diesels, and nine miscellaneous diesels left over from the previous equipment. Indianapolis is one of 22 terminals in the Hayes Division. Of the 22 terminals, eight are joint McLean-Hayes terminals. Indianapolis is the maintenance center, with repair shops and parts depots for handling all major repairs. In addition to the 124 tractors which carry traffic between terminals, the Hayes Freight Lines has 182 trucks of various makes, largely gasoline-powered vehicles, which pick up and deliver local freight within a given terminal area.

Six-cylinder GMC 6V-71 diesel engine is installed in the 100 new GMC DF-7000 tractors put into service by Hayes Freight Division. Engine is rated 189 gross hp at 1800 rpm, has 4½x5 in. bore and stroke.

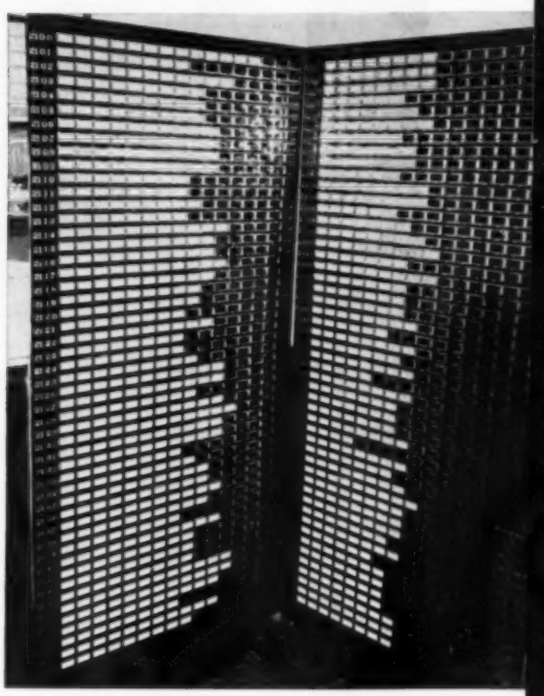
The fleet's in! Aerial view of Indianapolis terminal of McLean Co., and Hayes Division on a Sunday morning.

While much LTL freight is rehandled at various terminals, a solid load could be routed direct to Memphis, for example, from Chicago, Decatur and Peoria, Ill.; Indianapolis, Ind.; Lexington and Louisville, Ky.; Akron, Cincinnati, Cleveland and Toledo, Ohio; Pittsburgh, Penn.; Baltimore, M.D.; and Washington, D. C. Freight destined for points west of Chicago would be interchanged with concurring carriers in Chicago. Much service east of the Hayes Division area is interchanged with the parent company and many other inter-change carriers are also used.



View of maintenance shop at Indianapolis. The 6V-71-equipped DC-7000 tractors have Lipe-Rollway two-plate clutches, Fuller 10 speed R96 transmissions and Timken SLDD dual-drive 5.90 ratio axle.

Visual reference board has card for each truck. One move is made for each 4000 mi. on preventive maintenance schedule to 64,000 mi. A permanent card file also keeps lifetime record of each unit.



This interesting fleet of diesels which started to be put into commission about mid-May, was completed in June, 1960. The previous fleet was equipped generally with in-line sixes, the GMC model 6-71. The older vehicles which required replacements were dated 1951 and 1952, with some 1955 and 1956 models. According to C. W. (Charlie) Stewart, maintenance superintendent, the V-6s are more economical to operate, save time on their runs and result in a generally better utilization of the vehicles. Of the 100 units put into service, 50 are equipped with sleeper cabs and 50 with standard non-sleepers. The sleeper cab vehicles carry two drivers and run up to 11,000 miles per month, while the straight cabs run up to 9,000 miles a month, with one driver.

When headquarters at Winston-Salem decided to replace the Hayes fleet, many of the vehicles had close to a million miles to their credit. And, as mentioned, when installing the new fleet, it was found that with the more economical V-6 diesels, 124 units were able to more efficiently handle the work than 135 units did in the previous fleet. Despite the fact that there are now 11 fewer units on the road, the actual vehicle time on the highway has been materially reduced on many of the trucking firm's runs.

A carefully worked out preventive maintenance plan protects the fleet. Currently it is based on a 4,000 mi. unit mileage in accordance with previous experience on the former fleet. It is being discovered now after the initial months of service that the new vehicles will not require as frequent inspection and the increase of the 4000 mi. unit check period is being considered. A large pin-up board in Superintendent Stewart's office carries a card for each of the 124 vehicles. Vertical columns each represent 4000 mi. Cards are moved horizontally along after each 4000 mi. inspection from the left side to the right side of the board. The end of the board is reached at 64,000 mi., or sixteen inspections. As the cards move along the board after each inspection, the actual mileage is entered on the card. At this time oil changes and other routine service operations are performed.

The board constitutes a current record of maintenance operation. Information on the board, however, is also kept on a card file with a card for each vehicle. When the card reaches the end of the 64,000 mi. period, the vehicle represented is given a thorough going-over and a new card started at the end of the line. In the meantime, the previous 64,000-mile record has been entered on the master card which forms the permanent record.

Much of the maintenance planning results from a program carried on by GMC's Service Training Department. When a GMC fleet is established or augmented, a mobile diesel training school with instructor is sent in free of charge. This school not only helps set up modern maintenance record systems, but also gives shop personnel an intensive course on the specific methods of repair and adjustments be required by the equipment.

The V-6 engine is also proving the advantage of the inherent rigidity of the short, compact design. An interesting point illustrating this feature of the new diesel V-6s is the fact that although considerably shorter than the GMC in-line 6, the crankshaft is actually heavier. The entire engine weight, of course, is less due to the reduced dimensions of the block, and also the required space devoted to the cab is reduced in consequence. The regular cabs on these vehicles are only 48 in. long for the standard cabs and 72 in. for the sleepers.

While the V-6 diesel alone weighs 200 lbs. less than the in-line unit of the same displacement, this is only one of the weight-saving features of the new GMC tractor. Equally important is the new 696 lb. aluminum tilt-cab with its dimension of 48 in. from bumper to back of cab. With these weight savings, plus those derived from a new fabricated frame 300 lbs. lighter than previous designs, and through the use of independent front wheel suspension, the tractor can haul an extra ton of cargo and the unit will still be within the 61,000 lbs. gross combination weight rating.

The new 6V-71 diesel engine is a direct injection, 2-cycle unit with 4¼-inch bore and 5-inch stroke, a compression ratio of 17:1, and rated at 189 gross hp at 1800 rpm. Displacement is 425.6 cu. in. Its 138 lb. crankshaft, 63½ degree V-6 block angle provide a short, rigid compact powerplant balanced to operate with vibrationless smoothness. Many parts of the V engine are interchangeable with those of the in-line 6-71 unit formerly used in the Hayes fleet. This includes pistons, rings, wristpins, cylinder liners, cylinder heads, housings, timing and injector mechanisms.

Cummins NH-195 diesel engines powered trucks used in fleet which tested effectiveness of diesel fuel additive described in this article.

TREATING NO. 2 FUEL UPS PERFORMANCE, CUTS COSTS

Tests Show Ability of Additives to Inhibit Formation Of Gum Deposits to Extend the Life of Diesel Injector Cups and Plungers, Keep Power Output Up and Fuel Consumption Down

By JESS P. SMITHER*

A NEW additive treatment for No. 2 diesel fuel to obtain the benefits of improved equipment performance and lower operating costs has been developed at D-A Lubricant.

This treatment has been designed for operators who experience power loss and excessive smoking of exhaust stacks. Techniques such as reverse flushing of injectors have been tried in an effort to solve these problems with only partial success, and much unproductive down time occurs on expensive equipment while each unit is in the maintenance shop. The additive treatment has proven particularly effective in severe cases where injector replacements may be required at mileages ranging from 40- to 70,000 miles. These injector replacements add substantially to the cost of operating each piece of equipment.

Injectors removed from engines at these exchange periods show lacquer coatings on plungers and carbon deposits in metering orifices, spray holes, and on injector pintles and tips. These deposits impair proper injection action by causing injector sticking or sluggishness. Timing of fuel injection is upset and improper quantities of fuel burn incompletely causing a reduction in the power output of the engines. Excessive deposits of carbon distort spray patterns so that the fuel particles mix poorly with the air in the combustion chamber. Fuel combustion is incomplete and the smoke emitted with exhaust gases increases markedly.

Most straight No. 2 fuels for diesel use will form gummy, insoluble residues when exposed to elevated temperatures in the presence of oxygen. These insoluble residues were recognized as the source of the deposits causing operational difficulties of diesel equipment. Early research was specifically directed to the design of a thermal stabilizer for fuel which would inhibit the formation of these insolubles. Over a period of two and one-half years, numerous heating tests were conducted comparing treated and untreated diesel fuels in a search for superior stabilizers. In order to measure the particle size of gums generated in the heated fuel, electron microphotographs were taken of the residues resulting from each heating test. The electron microphotographs (see cut) demonstrate the stabilizing power of D-A Lubricant's new diesel fuel conditioner.

J. P. Smither

The ability to disperse insolubles and prevent their deposition on metal surfaces as lacquer coatings is another performance characteristic important in a diesel fuel additive. In order to measure the effectiveness of promising treatments as dispersants, a bench-scale injector-sticking rig was assembled in the laboratory. Diesel fuels containing chemicals which had been screened by heating tests and had shown promise as stabilizers were now tested in this rig, under conditions designed to accelerate fuel deterioration.

Numerous chemicals were screened using the injector-sticking rig until this new additive was developed. The performance of this stabilizer-dispersant in three typical diesel fuels is shown below:

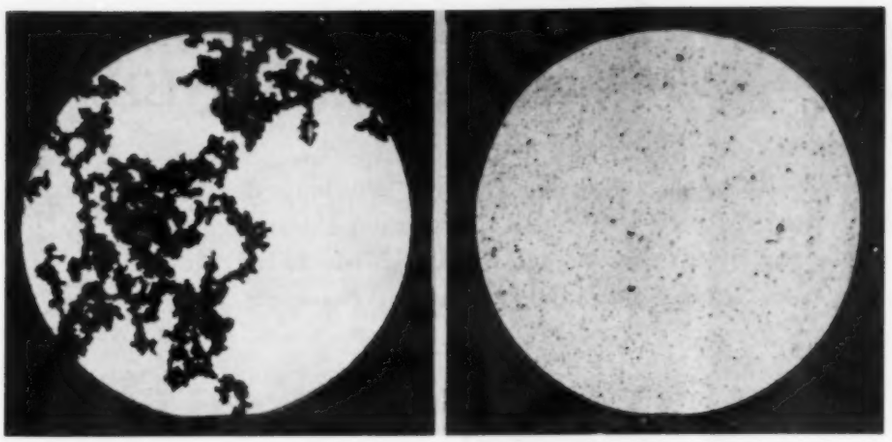
TABLE I

Fuel	Additive Concentration oz./50 gal. fuel	Hours to Sticking of Injector Plungers
100% Cat. Cracked Stock	none	20
	2 oz./50 gal. fuel	162
Economy Diesel A	none	62
	2 oz./50 gal. fuel	250
Economy Diesel B	none	32
	2 oz./50 gal. fuel	154

In one of the fleet tests in which D-A Lubricant's diesel fuel additive was evaluated, trucks were powered by Cummins NH-195 diesel engines.

Diesel fuels containing chemicals showing promise as stabilizers were tested in this special rig in D-A lab.

*Director of Research D-A Lubricant Co., Inc.



Electron microphotographs show particle size of gums generated in untreated fuel, left, and treated diesel fuel, right.

Two trucks were equipped with new injectors and operated on a No. 2 diesel fuel compounded with 2 ounces of additive per 50 gallons of fuel. Reverse flushing of the injectors was not practiced during the test interval. Injectors in this fleet were normally replaced at intervals of approximately 50,000 mi. because of driver complaints of power loss and excessive smoking.

After completing 70,000 mi. on the treated fuel under operating conditions normal to this particular fleet of trucks, injectors were removed from the test vehicles. Comparisons were made with injectors taken from trucks that had been operating under similar conditions but using the same untreated fuel. Figures I, II and III are photographs of the injector cups and plungers after 70,000 test miles. These photographs illustrate the ability of D-A Lubricant's new diesel fuel additive to reduce deposit formation effectively, and keep power output, exhaust smoke, and fuel consumption at essentially clean levels.

Several trucks in this fleet have operated on treated fuel over prolonged intervals between partial engine overhauls without requiring injector maintenance of any kind. Figures IV and V are photographs of injector cups and plungers after 240,000 test miles on treated fuel. These injectors were still operating efficiently when removed for inspection purposes. The advantages obtained with proper fuel treatment are clearly demonstrated.

Of special significance to fleet operators is the fact that at no time during the test was it necessary to reverse flush the injectors in trucks operating on additive treated fuel.

The use of the new diesel fuel additive not only improved the operation of the trucks for 240,000 mi., but also saved the cost of four injector replacements which previously had been considered necessary by this fleet operator.

One of the nation's largest private fleets, operating across the country with a wide range of climatic and road/load conditions, tested this diesel fuel additive on three different types of engines: Cummins, Mack and General Motors. This company found that in more than a million and a quarter miles of testing fuel with additive and without, drivers reported: ". . . less soot from vertical exhaust"; ". . . engines seemed to perform better"; ". . . injectors were checked and no carbon on injector tips."

Figure VI shows an injector tip which was removed at 200,000 mi. for inspection although the engine was showing no difficulties.

This injector tip and its plunger had run for 150,000 mi. on treated fuel after having developed trouble at approximately 50,000 mi. on untreated fuel. The comparison of this set of injector parts with those shown in Figures I and II indicates the ability of the additive to clean up previously deposited fuel residues.

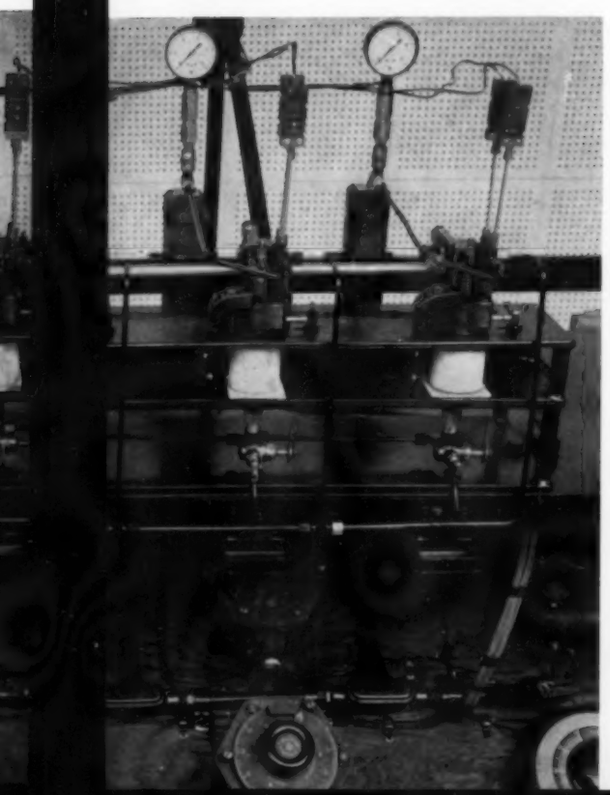


Figure I

Figure II

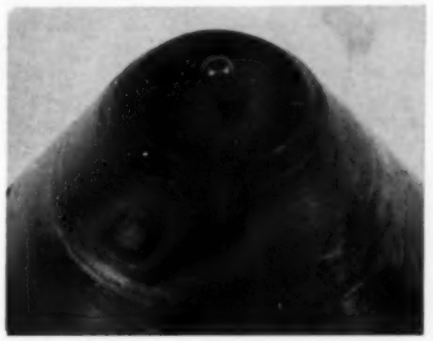


Figure III

Figure IV

Figure V

Figure VI

BENDIX LOW TENSION IGNITION SYSTEM FOR SMALL, MEDIUM SIZED ENGINES

Scintilla Divisions S-500 Series System Offers "Packaged Concept" to Makers of 4 and 6 Cylinder Engines; Units Adaptable to Maximum 3000 RPM Speeds; Available With Impulse Couplings or Retard Breaker, Vibrator Booster

EXPANDING application of natural gas engines, coupled with the move to higher compression ratios, has resulted in important ignition system developments in recent years. Emphasis has been placed primarily on easier starting, increased reliability and longer spark plug life, and system simplification. One of the manufacturers moving strongly in this area is the Scintilla Division of Bendix Corp., which has been actively engaged in the production of ignition systems for industrial engines since 1932.

Latest development of the Scintilla Division is the S-500 low tension ignition system for light and medium hp industrial engines. In this design, attention was focused on the "packaged concept" to offer advantages of low tension ignition for these smaller and medium sized four and six cylinder industrial gas engines.

The S-500 ignition system consists of the magneto, transformer, coils, harness assembly, starting vibrator, and ignition switch. The system is supplied either with impulse coupling or retard breaker and vibrator booster for starting. It is supplied for either shielded or unshielded operation and for either base or flange mounting.

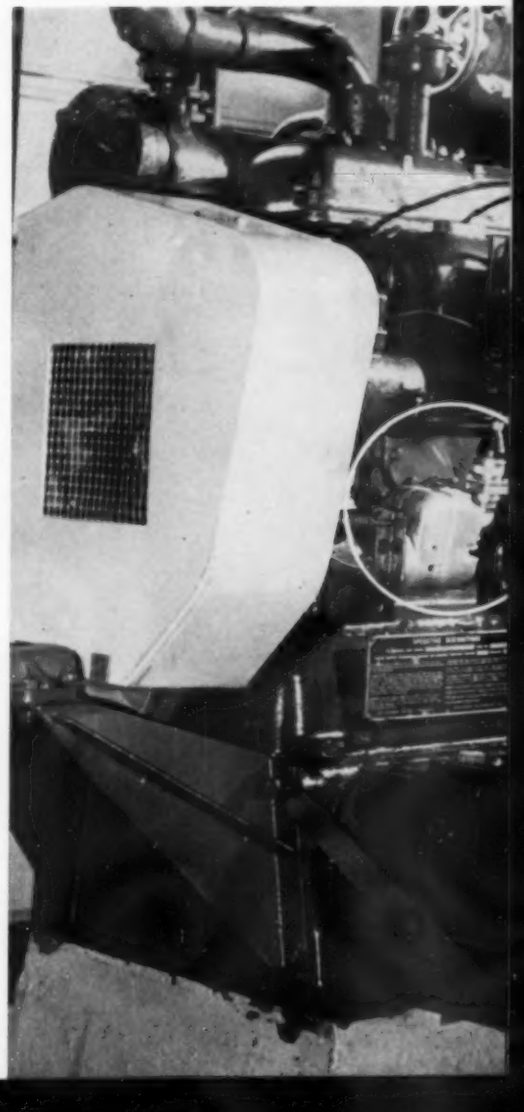
Advantages seen for low tension ignition are that low voltage is generated by the magneto and transmitted through the wiring harness to transformer coils located near each spark plug. The transformer coils step it up to higher voltage current which is then transmitted to the spark plug through a relatively short high tension lead. This permits maintenance of minimum electrical stresses in the system. The short high tension lead is easily shielded and insulated to withstand the stresses imposed on it.

The S-500 series has been designed and extensively field proven to perform under severe environmental conditions and models are available and adaptable to several engine applications. In addition to the positive quick disconnect of the harness at the magneto, Bendix also offers stud connections for engine applications using open wiring. Features of the S-500 series include maximum operating speeds to 3000 rpm, tungsten breakers, approx. weight of 6 lbs. 8 oz., clockwise or counterclockwise rotation, lag angles adjustable in increments of 5 degrees and lug angles of 2.5 degrees in increments through 360 degrees. Retard breaker installations offer spark retard settings of 20, 25, 30, and 45 degrees.

Basically, operation of the S-500 low tension system is as follows: With the ignition switch "on," current flows from the battery through the normally closed vibrator contacts, vibrator coil and the magneto primary coil. The magnetic field created draws the vibrator armature down, breaking the circuit. This continuous interruption of current flow through the magneto and transformer coil primary induces a high voltage in the secondary of the coil, resulting in a "shower of sparks" at the spark plugs. As the engine picks up speed, the ignition switch will be released, disconnecting the starting vibrator and retard breaker for the circuit. The main breaker now controls the spark through the coils and to the plugs.

In addition to the system described above, Bendix

Bendix S-500 low tension ignition system includes retard breaker magneto, starting vibrator, coils, harness assemblies and switch.



Ignition characteristics of S-500 low tension system have helped extend spark plug life considerably on this Waukesha 140 series engine operated by Waukesha (Wis.,) sewage treatment plant. With older system plugs were cleaned every four days, replaced each month. Since new system was installed in February plugs have been run as long as three weeks without cleaning, only two, at first inspection, required replacement.

also provides S-500 magnetos with impulse couplings as some engine applications are not readily adaptable to the new design. This system includes coils, harness assemblies, spark plug leads, switches, and magnetos with a main breaker only.

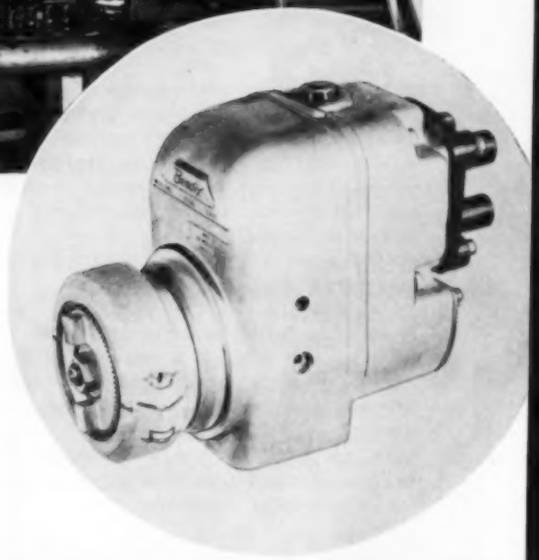
The 12 or 24 volt starting vibrator used in conjunction with a battery and retard breaker is available with or without a relay, depending on the starting switch used. Leads and harness assemblies are fabricated from military approved wire and protected by an outer sleeve unitized to the electric connector. Shielded or unshielded spark plug leads are also available.

Bendix also produces a number of other low and high tension ignition systems for industrial engine applications. These include:

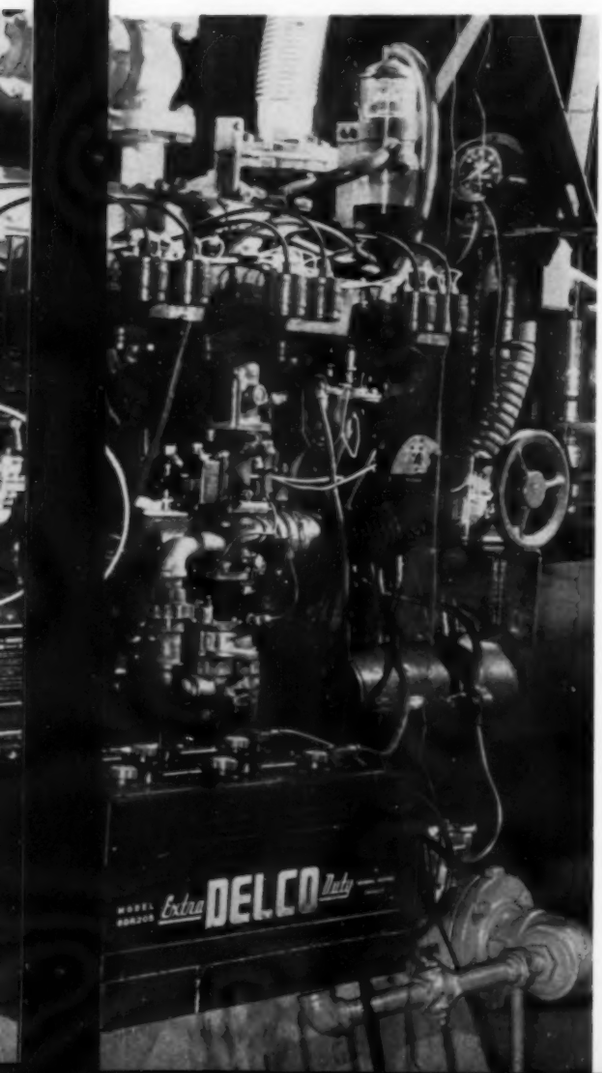
The LAR series, a low tension system for medium and large size engines up to six cylinders. The LAR series is adaptable for single or dual ignition and Bendix Hi-V transformer coils and specially designed cable assemblies are provided for use with the LAR magneto to effect a balanced system insuring effective and efficient operation.

Another low tension system is the LC-DLC series also for medium and large sized engines to six cylinders. This system is designed for large, high compression, low speed engines used as prime power sources in industrial, marine, natural gas, and petroleum installations. High energy output is produced at normal cranking speeds, thus eliminating the need for impulse coupling. The main shaft is connected to the engine drive with a simple drive member and disc. The DLC (dual ignition) is similar to the LC type magneto except that it incorporates two sets of pole shoes, and two each of magneto coils, main breakers, and capacitors to make a true dual ignition unit.

LC series is low tension system for medium and large low speed, high compression engines to six cylinders. This installation is on a Cooper-Bessemer engine at Pampa (Tex.,) compressor station of Pioneer Gas Co.



This is Bendix S-400 magneto, high tension magneto for small and medium size engines of from one to six cylinders. Configuration is similar to S-500 low tension series.



One of Bendix's line of high tension systems is the S-400 series adaptable to a wide range of small and medium size industrial engines of from one to six cylinders. Impulse couplings with adjustable time lag and lug positions are used to provide for maximum installation convenience. This magneto is designed to permit convenient and effective radio shielding should this be necessary.

For their low tension ignition systems, Bendix has available cable assemblies designed to give maximum protection to circuitry of the ignition system under most severe operating conditions. Heavy plastic conduit molded to the electrical connector provides a weather and environmental resistant assembly. A single control switch, also available, permits positive control of high and low tension ignition or battery systems and has a removable key feature.

Magneto for LAR series low tension ignition system for medium and large engines to six cylinders is adaptable for single or dual ignition.

AUTOMATING THE DIESEL ELECTRIC UTILITY

A Condensation of a Paper in Which Design Philosophy and Details of the System Are Outlined to Tell What Is Necessary for Complete Automation and How It Was Done in a Plant With Three Different-Sized Engines

By R. D. HAMILTON*

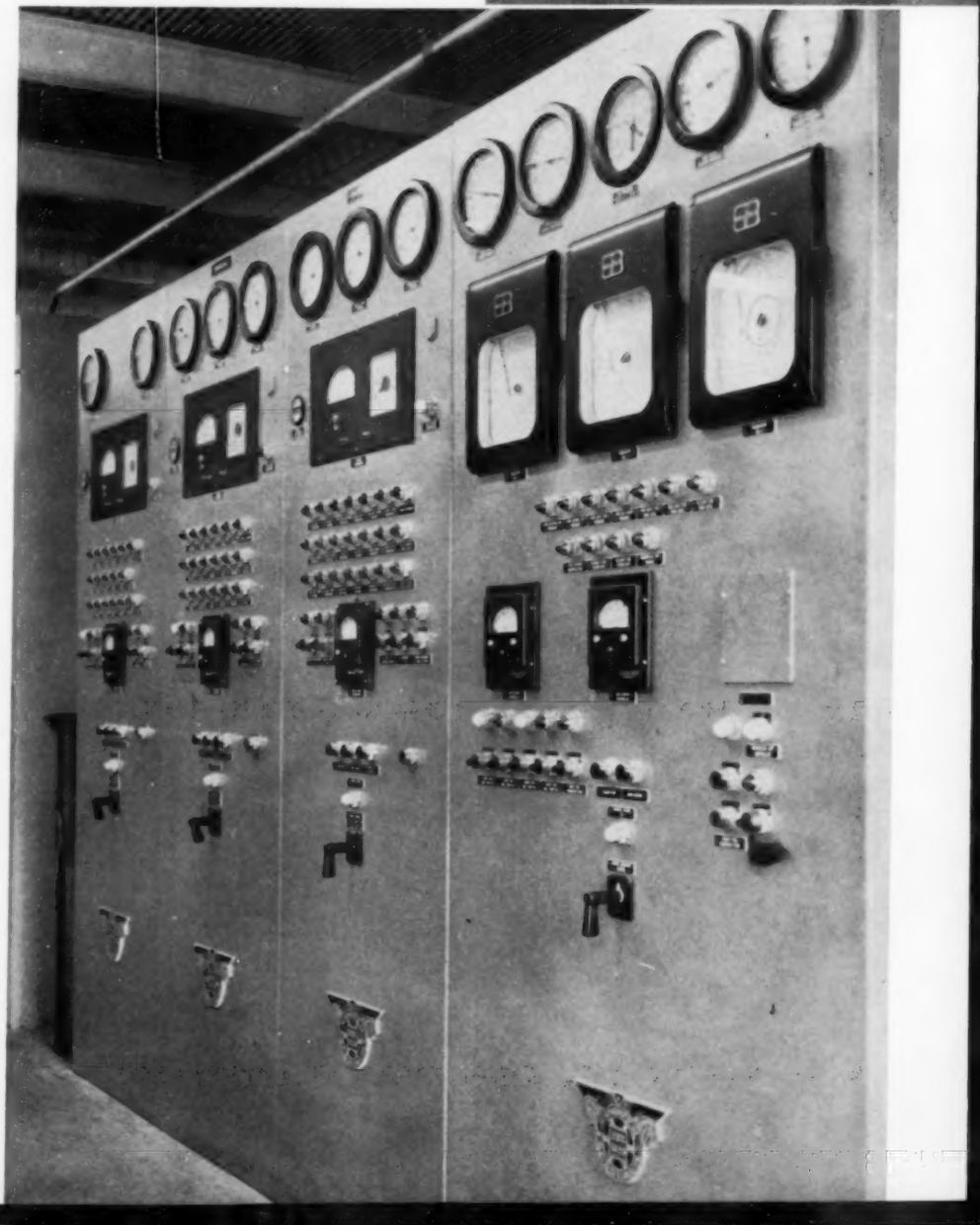
FOR years, prime-mover equipment utilizing oil and gas as a fuel has been hand-operated. This prime-mover equipment, whether used in the utilities or in gas and oil-field applications, has been furnished with a combination of valves and levers with which to start, stop, load, and unload the machinery. These valves and levers, when operated by the skillful operator, work the equipment quite efficiently.

However, the fact is that this operation is not as efficient as when it is done automatically. Witness the governor on an engine. Speed control could be manual, but how much better it is with the governor. Faced with this fact, faced with competition, and faced with personnel problems, the utility people and the gas and oil people are moving toward complete automation.

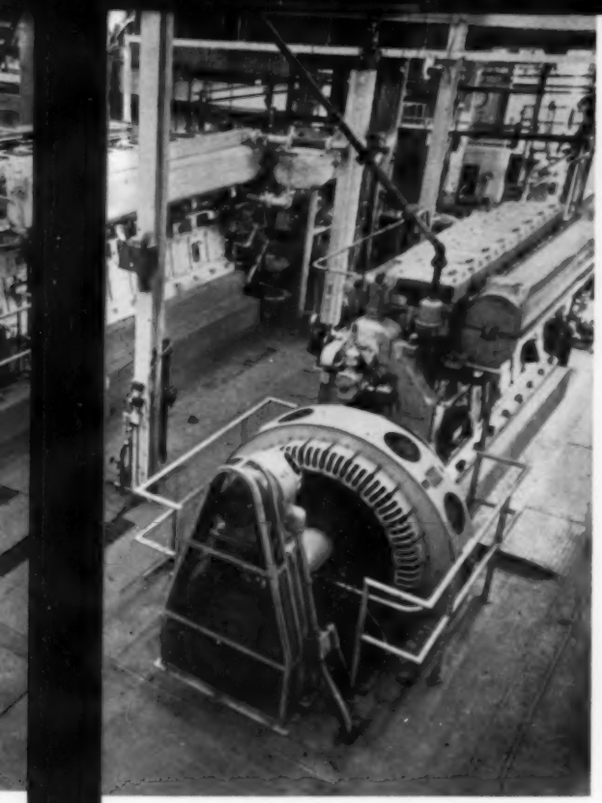
The problem then becomes: What is necessary for complete automation of a utility? The question might be: What is the best first step to safer, more efficient operation—or how can we give the operator the improved operating components and sequencing he wants and needs? In any case, first state the ultimate objective in black and white, then pin-point the necessary steps to be taken to accomplish this. For example: The objective in a small power plant using liquid fuel is to be operated unattended except for daylight maintenance personnel. This is complete automation briefly stated. At Nantucket, Mass., just such a small plant exists, and the problem has been solved. The automation at this plant, which has three different size engine-generator sets generating power for this small resort island, first had to be analyzed carefully. Such an analysis resulted in the decision that this automation would require:

For the Engine: Sequence starting; alarm monitoring; shutdown protection; complete fuel-system

*Assistant Manager, En-Tronic Controls Division, Cooper-Bessemer Corp., Mt. Vernon, Ohio. *From a paper (No. 61-OGP-8), delivered at the ASME Oil and Gas Power Conference, New Orleans.*



The three En-Tronic engine control panels and station control panels which handle the Nantucket station operation.



Three engine generator sets are installed at Nantucket. The plant has a rated capacity of 2950 kw.

automation (this includes automatic fuel change from No. 2 diesel to and from residual fuel operation); auxiliary sequence control (including pre- and post-lubrication); cooling-system automation; and lubricating-system controls.

For the Station: Engine-order selection; engine by-pass ability; Sen-s-tron start and stop signal and control; automatic synchronizing; unit load sharing; dead buss starting; residual-fuel handling and cleaning; alarm monitoring; and shutdown protection.

For simplification purposes and for ease of understanding and engineering, each of these systems was attacked individually. A building-block design system resulted. Each system then became a small part of the total over all, is easily applicable to future work, is easily analyzed and understood. In addition to the automatic station switchgear, the following equipment was designed and built to accomplish the complete automation:

For each engine-generator unit: One floor-mounted control panel containing the engine-sequence starting, the alarm and shutdown relays with visual and audible alarms, controls for auxiliary equipment, instrumentation for checking the performance of the unit, such as pressure and temperature gages and a scanning-type pyrometer monitoring cylinder temperatures continuously. One set of on-engine controls, which consisted of pressure and temperature-sensing devices for monitoring the unit. Such pneumatically and electrically-operated valves as are necessary to start and control the unit under all conditions.

For the Station: One floor-mounted station control panel, which housed the engine-order-sequence selection, the various auxiliary controls common to all engines. Inside this panel is the Sen-s-tron system which controls automatic starting, stopping, loading, and unloading of the engine according to the station load demand. One wall-mounted residual fuel control panel, which controlled the pumps and the centrifuges necessary for cleaning and preparing the residual fuel for use.

Nantucket Gas and Electric Co. has three engines—No. 3 is rated at 1250 kw; No. 2 is 1000 kw; and No. 1 is 700 kw. Since this is a resort island off the coast of Massachusetts, the population as well as the electrical load varies tremendously between winter and summer (certainly not ideal operating conditions for any utility.) This tremendous load variation was one big factor in the decision to accomplish the complete automatic station.

Hardware and modules have been established. To see how each of these building blocks fits into the over-all automation picture, let's follow an engine start-up procedure for the station.

Engine-order-sequence selector: The engine sequence selector allows selection of any arrangement of engine order. Either engine No. 1, No. 2, or No. 3 can be selected as the lead unit, and engine-order sequence for coming on the line and sharing the load can be selected as 3-2-1, 3-1-2, or 2-3-1. This selection of the preferred sequence is manual and usually depends on the total hours on each unit. When a sequence has been selected, at least one engine is always operating, generating the station load. When the station load reaches the desired proportion of the load-carrying ability of this engine, (usually at or close to its full-load capability) an automatic signal is sent to start the second engine.

Automatic start and stop signal: Load sensing is accomplished by the Sen-s-tron. This load-sensing device is designed to measure load accurately and to instigate starting or stopping as the load demands change. The Sen-s-tron is a combination of devices, one of which is a thermoverter installed in each generator output. When a unit is loaded to its adjustable set point, the Sen-s-tron signals the starting circuitry for the next engine in sequence to get it underway.

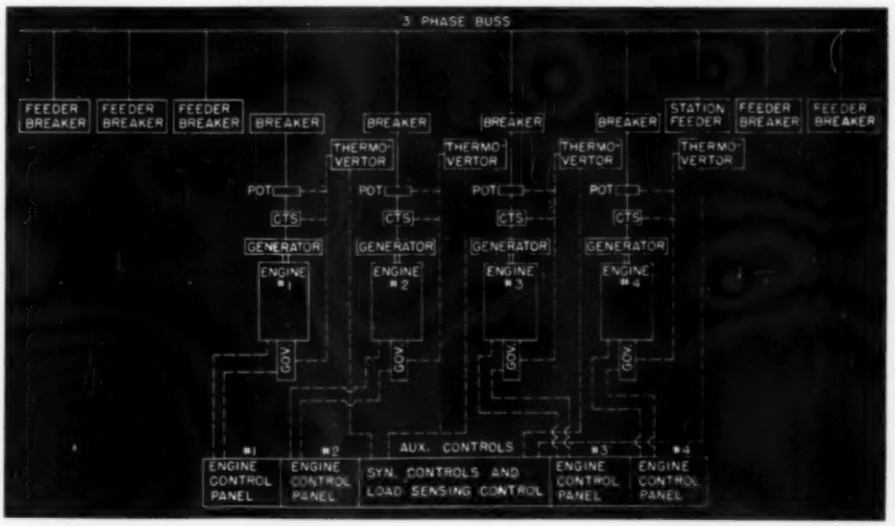
Engine-sequence starting: The starting signal activates the individual engine-control system and initiates proper functioning of any auxiliaries, such as prelubrication. Valves and control devices are positioned properly preparatory to starting. When the preliminary functions have been performed and proper timing periods satisfied, the signal is sent to begin rolling the engine on air. No. 2 diesel fuel is injected into the cylinders causing the engine to accelerate, come up to speed, and come under governor control.

Automatic synchronizing: All the conditions for starting have been satisfied; therefore, a signal is sent by the control system to the automatic synchronizing equipment. Now the engine, under control of this synchronizer, is speed adjusted to match the unit on the line. Its generator output is compared and synchronized with the one or the two engines that may be on the line. When properly speed matched and synchronized, the generator breaker is closed and this engine then is on the distribution line.

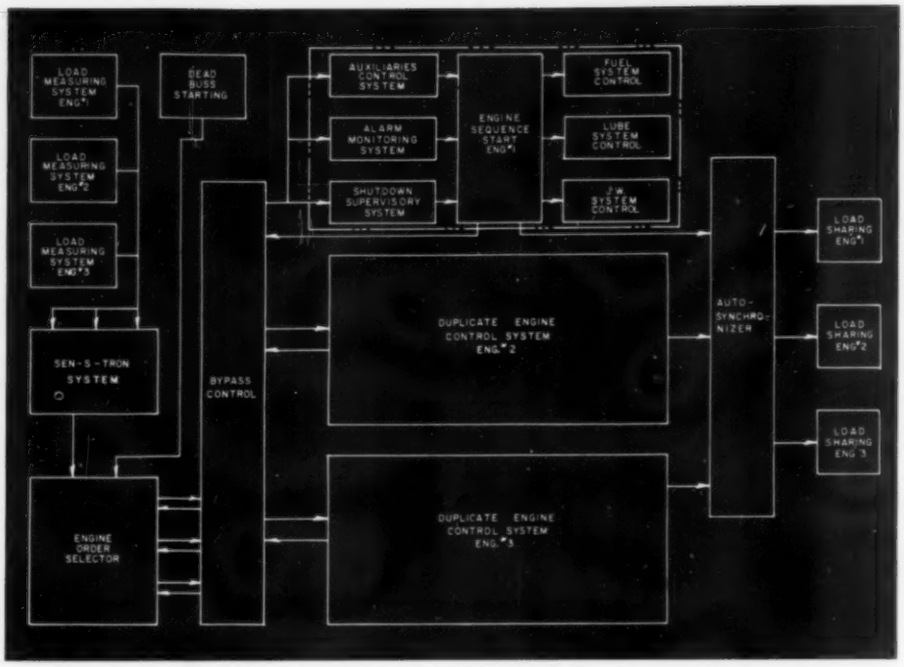
Load sharing: The controls system is designed to put a small load on this new generator when the generator breaker is closed. This is necessary, as in all utility operations, to prevent motorizing of the generator. Automatically, the control system slowly loads this second engine. The load carried by each engine is shared in direct proportion to its full-load capabilities. The station load, therefore, is split between these two units in an economical manner.

Fuel-system control: When the second engine has completed its starting sequence, the fuel changeover system is sent an electrical signal. The heavy fuel system used at this station is similar to the heavy fuel system that has been used in a number of installations. Primary, secondary, and booster

Schematic diagram showing typical automatic generating station.



Block diagram of typical engine generating system.



heaters and heat exchangers are used to get the fuel to the proper temperature. Cleaning of the fuel through strainers, filters, and centrifuges assure that the residual fuel is properly processed for use in the engine.

The fuel cleaning system and the heating system are entirely automatic. When the conditions of temperature are met, and the control system indicates it is the proper time for changing to heavy fuel, this changeover is accomplished through solenoid valves at the engine. This fuel changeover system requires a purging period so that before shutdown and removal of an engine from the line, the control system provides that No. 2 diesel fuel be circulated through the engine fuel system. This prepares the engine for future startup and eliminates any fuel-system problems. It was found more economical to purge the fuel system of No. 6 fuel while the engine was still under load. This reduced the purging period and allowed use of this fuel for power generation during the purge period. Since purge time was reduced, there was a definite reduction in fuel costs.

Alarm monitoring and shutdown protection system: The alarm system monitors jacket-water temperature, lube-oil pressure, lube-oil temperature, exhaust temperature, and many other vital points in the functioning of the engine. In the event any of these reaches an alarming value, a visual alarm is lighted and an audible alarm is sounded. If this apparent malfunctioning continues to a point considered dangerous to operating, the shutdown circuit is energized and the engine is shut down under complete control of the system. A red pilot light goes on to indicate the cause of the shutdown. The audible alarm is sounded. Heart of the shutdown system are the sensing devices used to sense a malfunction in speed, temperature, pressure, and vibration.

Unloading: When the Sen-s-tron indicates that the load requirement for the station has dropped so that No. 2 engine is no longer required, a signal is sent to the unloading and stopping circuits to remove this engine from the line. First, purging of heavy fuel is accomplished, then the load being carried by No. 2 engine is transferred to engine No. 1. In order to prevent motorizing of this generator, the circuit breakers are tripped while the No. 2 engine is carrying a small load. No. 2 engine is now removed from the line and when all conditions are satisfied, it will be sequence-stopped. The auxiliary control circuit maintains a post-lubrication by operating the pre-lube pump and controlled cooling by operating the circulating-jacket-water pump a predetermined time after the engine is stopped.

By-passing: The engine-order selector, while set to, say, start engines in the sequence of 3-2-1, may find engine No. 2 will not start. In this case, the control system, after trying to start engine No. 2, will by-pass and start engine No. 1. Such a by-pass can be accomplished manually at the engine panel or it may be accomplished automatically.

Dead buss starting: Operating completely unattended for even a short period definitely established the need to be able to start automatically from a dead buss. Under some conditions, only one engine might be generating the power for the utility. A serious malfunction will stop that engine immediately and the station power will be gone. By having the capabilities of dead-buss starting, restoration of station power is established in a minimum of time. The dead-buss starting system incorporated in this control, when signalled, will immediately start another engine. As soon as the engine is up to speed and since no synchronizing is required, the control will start, bringing in the station line feeders in a pre-arranged sequence. This prevents over-loading the newly started engen, and the outage, therefore, is at a minimum.

Its operating record has proven the economic and other advantages of such a system at Nantucket. The staff in this or any other plant can operate a larger plant when controls are used. The controls remove the human error in operation, and more importantly, in judgment. This has been proven in actual operation because now the engines are brought on the line when they are needed. This control system has also proven that it effectively increases engine availability. Of course, it cannot increase total rated output, but by increasing the engine-generator availability, there is a definite increase in total production. Maintenance costs can be reduced through the use of this automatic system, through the more precise control of the engine and its auxiliaries. The proof of the effectiveness of such a system is in the satisfaction of the user. Such equipment is the thing of the future on small utilities and, of course, on oil and gas transmission.

* * *

During his talk at New Orleans, Mr. Hamilton added the following facts gleaned after the paper was written:

Proof of the effectiveness of such a system is in the satisfaction of the user, and in its operation over the past 18 months. One such proof of the operating effectiveness is the following statement from Mr. G. C. Snow, Vice President, Nantucket Gas and Electric.

"On July 1 at 2:10 A.M. our No. 3 engine tripped out on overspeed shutting down the town. It is felt that this was caused by an automobile hitting one of our poles, knocking out the main breaker; however, in one minute and 40 seconds power was returned to the switchboard through our crash shutdown controls which calls for the starting of another engine. Perhaps the best expression was from our supervisor of maintenance, J. F. Chase, and I quote 'I did not have time to get my pants on before service was restored.'

Naturally we were all very pleased as we lived a long time getting our set-up in operation and as is natural everyone is somewhat skeptical until it really operates when you want it."

Sen-s-tron load sensing unit.

Studebaker diesel tractors are rated 19,300 to 23,000 lbs. gvw., and units are offered in four wheelbases from 131 to 195 in. Power plant is a GM Detroit 4-53 engine rated 130 hp at 2800 rpm.

STUDEBAKER'S MEDIUM DUTY DIESEL LINE

STUDEBAKER-Packard Corp., has entered the diesel truck and tractor field with a new medium duty series, among the first in this gvw class built for and available with production type automotive diesels. The units are in the 19,600 to 23,000 lbs. gross vehicle weight range and are rated at 35,000 and 41,000 lbs. gross combination weight. Four wheelbases are available and they range from 131 to 195 inches.

Power plants for the truck series is the model 4-53 engine manufactured by General Motors Detroit Diesel Engine Division. The 4-53, a four cylinder, two cycle unit, was introduced by Detroit Diesel in 1958 and has been performing very well in hundreds of typical medium truck applications which were conversions from gasoline to diesel. These included both over-the-road and pickup and delivery operations.

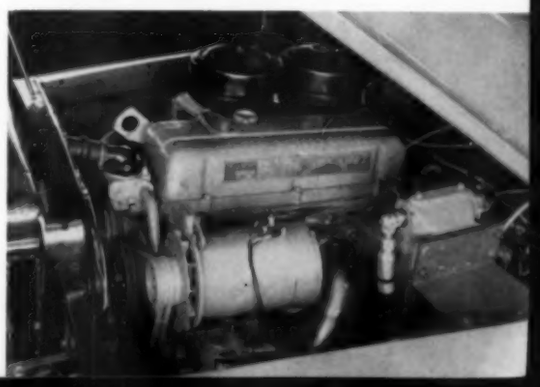
The 4-53 is rated 130 hp at 2800 rpm and delivers 271 lbs. ft. of torque at 1500 rpm. The engine has a bore and stroke of 3⅞ in. x 4½ in., compression ratio of 17:1 and displacement of 212.3 cu. in.

Studebaker will market the new diesel units through their present auto and truck dealers and through some "truck only" outlets. Part of the decision to utilize the 4-53 was based on readily available service and parts facilities of Detroit Diesel dealers throughout the country, according to company officials.

In marketing the medium duty tractor, Studebaker is aiming for a market that has been dominated by gasoline units in this country. They are shooting for a portion of the over-the-road market, of course, but in addition expect their diesel trucks to carve out a segment of the short haul, stop-and-go market and applications with long idle and/or power takeoff characteristics as well. Production on the 6E45 series began in June. The units are being assembled on the same production lines as are Studebaker's gasoline trucks. In the air are indications that a companion unit, with lower gvw, may be announced soon.

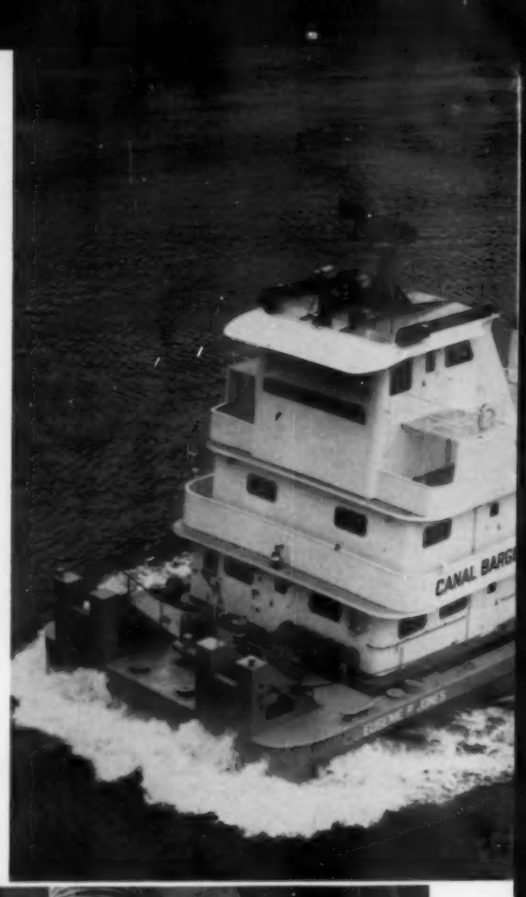
Standard transmission on the 6E45 tractor series is a direct four speed unit by New Process with 6.685:1 ratio. A direct five speed transmission with 6.06:1 ratio is available as optional equipment as is an overdrive synchromesh transmission. Clutches are Borg & Beck single plate dry type, 11⅞ in., rated 310 lbs. ft. torque capacity. Standard propeller shafts on all models are by Spicer. Timken rear axles with 5.29:1 ratio are standard and two speed axles are available as optional equipment. Clark front axles are supplied as standard equipment. All standard electrical equipment is supplied by Delco-Remy with a Leece-Neville alternator optional.

Underhood view of Studebaker 6E45 showing 130 hp GM diesel installed.



CANAL BARGE LINES ADDS FOUR TOWBOATS, 16,120 HP

Nordberg and GM Cleveland Diesels Provide Power for Vessels Which Will Transport Integrated Tows of Molten Sulphur and Petrochemical Products On Intracoastal Canal and Mississippi River

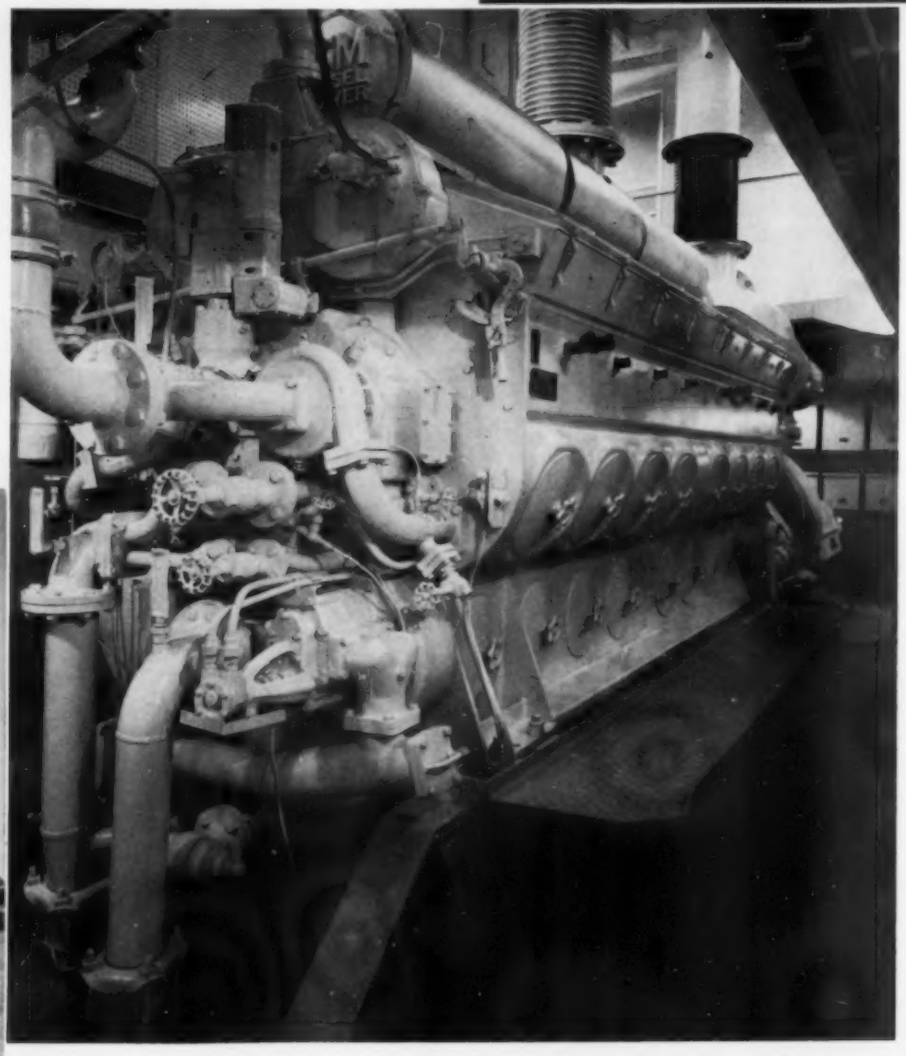


FOUR new towboats with propulsion power totaling 16,120 hp are flying the flag of the Canal Barge Lines Co., on the inland waterways. The new vessels were added to Canal Barge fleet since last December.

The new lineup includes the *Ned Merrick*, powered by a pair of GM Cleveland diesels, the *Eugenie P. Jones*, and *Susan Lane*, each powered by Nordberg diesel engines and the *Leonidas Polk*, also with GM Cleveland power.

The *Merrick*, built by Southern Shipbuilding Corp., at Slidell, La., is now in service pushing integrated petroleum tows between Chicago and Houston. She is powered by a pair of GM Cleveland 16-567 diesels each rated 1640 hp at 800 rpm. The diesels turn specially designed 102 in. dia. Coolidge propellers through Falk Airflex clutches and 3.769:1 reverse-reduction gears. The *Merrick* is 145 ft. long, is 35 ft. in the beam, has a depth of 11 ft. and operating draft of 8 ft.

A retractable pilothouse, which can be lowered 10 ft., allows the *Merrick* to pass under low bridges in the Chicago area. Transporting multiple petrochemical barges from Texas to Chicago, she will operate on the Gulf Intracoastal Canal and the Mississippi River system. The vessel can make the round trip from Houston to Chicago, pushing a capacity load in excess of 12,000 tons, in 20 to 22 days, including loading and unloading.

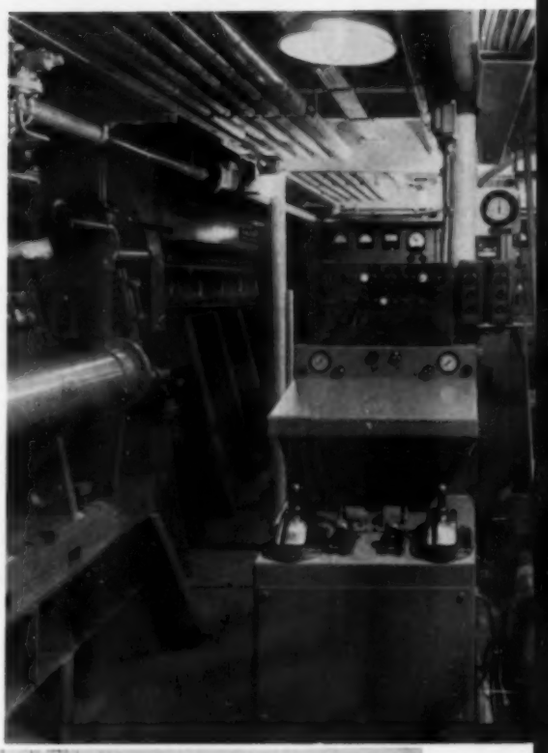


Propulsion power on the *Ned Merrick* is provided by a pair of GM Cleveland model 16-567 diesels each rated 1640 hp at 800 rpm and driving through Falk reverse-reduction gears. Engines are equipped with Briggs lube oil filters, are supplied with starting air from Gardner Denver compressors.

The *Merrick's* pilothouse can be lowered 10 ft. to allow the vessel to pass under low-clearance bridges in the Chicago area. Hydraulic ram which raises pilothouse is visible at center.

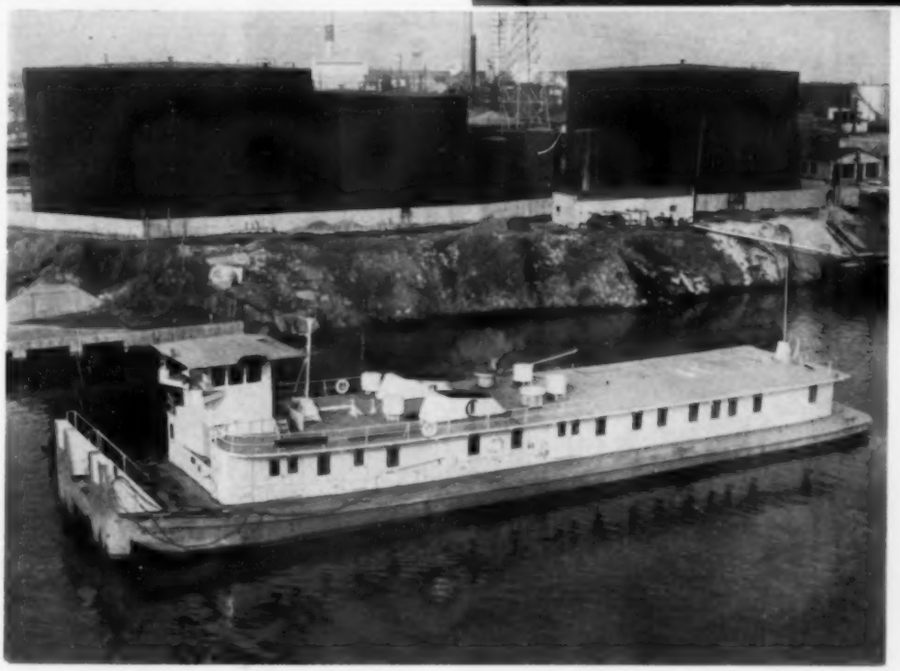
Eugenie P. Jones, and *Susan Lane* are both powered by Nordberg marine diesels. The sister ships are used to transport sulphur which is kept in molten state in specially designed barges.

Two Nordberg model FS-138-HSC diesel engines, each rated 2160 cont. hp at propeller speed of 219 rpm, drive the *Jones* and the *Lane*. Power is transmitted through Lufkin reverse-reduction gears and Wichita clutches to the 8½ ft. dia. propellers.



The *Eugenie P. Jones* and the *Susan Lane* will be used by Canal Barge Lines Co. for moving molten sulphur up the Mississippi River system to distribution terminals serving chemical plants in the Chicago area and upper Ohio River valley. Each tow consists of four heated tank barges. Capacity of each tow is 10,096 long tons of molten sulphur at 9 ft. draft. They will load at the Port Sulphur, La., plant of Freeport Sulphur Co. Including a day for unloading, the towboats can make a round trip from Port Sulphur to Joliet, Ill., and back in 15½ days and to Wellsville, Ohio, and return in approx. 19½ days.

Ned Merrick pushes integrated tows containing petro-chemical cargoes from Houston to Chicago in 20 to 22 days. *Leonidas Polk* is similar in construction but has two 2100 hp GM Cleveland engines.



The *Merrick* makes up integrated tows at Houston, drops off box barges at intermediate points on the Intracoastal Canal and Mississippi and discharges its main load of petrochemicals at Chicago. Special high flow pumps and piping to individual compartments enables each barge to handle a variety of petrochemical products. The barges are mostly of double-skin construction and vary in capacity from 1,200 to 1,900 tons each.

The new sister-towboats, the *Eugenie P. Jones* and the *Susan Lane*, built by Dravo Corp., are 148 ft. x 34 ft. x 10½ ft. They are powered by twin Nordberg model FS-138-HSC, four cycle Supairthermal diesels each rated 2160 hp at 219 propeller shaft rpm. These engines are equipped with Lufkin reverse-reduction gears with Wichita clutches. Four bladed propellers of 8½ ft. diameter and made of high tensile steel turn in Kort nozzles. Just forward of each propeller is a single steel strut which supports the propeller shaft.

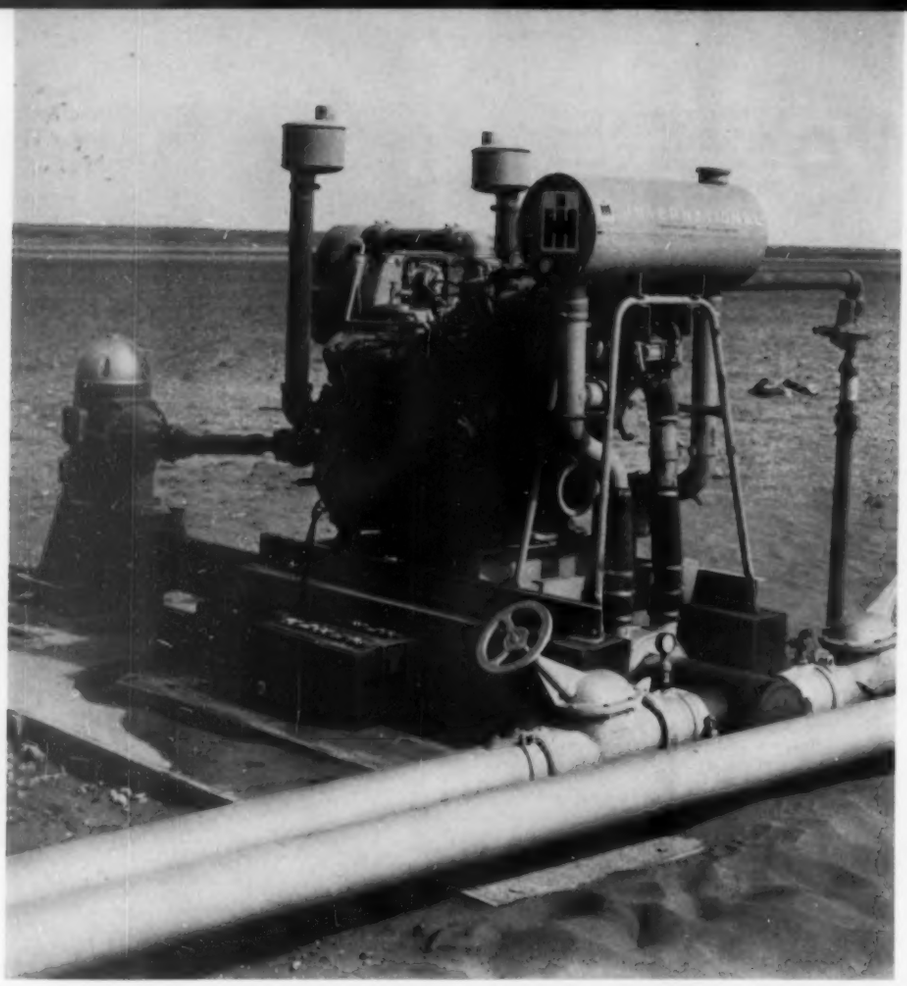
The engine-driven jacket water and inter-cooler pumps circulate clean water through the engine, lubricating oil coolers, aftercoolers and hull skin coolers. Separate skin coolers are fitted for the auxiliary engines.

The pilothouse, which can be raised 6½ ft. to provide full visibility when the tow is riding light, houses controls for complete towboat operation, with the exception of engine starting. Steering is controlled by means of push rods running to the steering compartment. Through the follow-up system, rudders remain at the same angle as the levers in the pilothouse, giving the pilot a constant indication of rudder positions. Six semi-balanced rudders control the vessel's course. One is located aft of each propeller for steering ahead and two are forward of each propeller for flanking.

Each tow consists of a 295 ft. lead barge, a 295 ft. and a 220 ft. box barge and a 220 ft. trailing barge. All are 52 ft. wide and 12 ft. deep. Two cylindrical tanks are installed in each barge. Total tow length is 1179 ft. permitting full single locking. While transporting sulphur, the barge tanks are heated by thermal fluid circulating through heating coils in each tank to keep cargo temperature between 260 and 270 degrees F. Sulphur solidifies at about 238 degrees F.

The *Leonidas Polk* was the last of the four to enter Canal Barge Lines service. This towboat also will be used to transport petrochemicals. She is powered by a pair of GM Cleveland 16-567 turbocharged diesels rated 2100 hp each but is otherwise similar in design to the *Merrick*.

Addition of the vessels brings Canal Barge Lines' fleet to 11 towboats. The firm was one of the pioneers in use of high-speed diesels for towboat propulsion and, in 1938, operated the first towboat utilizing air clutches. Canal Barge Lines also has 40 barges of 95,000 tons capacity.



I-H SYSTEM FOR ENGINE COOLING

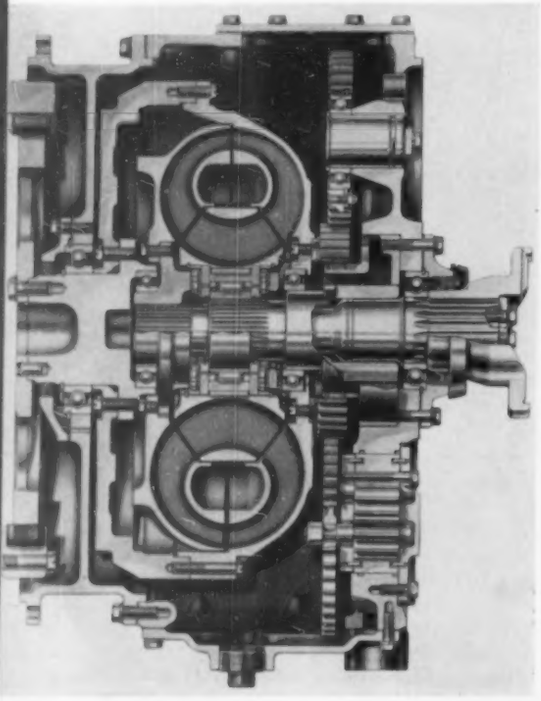
A COOLING system for non-radiator cooled engines has been developed by International-Harvester. Designed for International engines, the new Flo-Matic control maintains a high-volume, high velocity coolant flow, producing more uniform engine temperatures. As a result, International engineers state, service life of valves, pistons, piston rings, and sleeves is greatly extended. Hot spots and steam pockets are eliminated, and foaming and air entrainment problems, inherent with continuous duty applications, are controlled.

Flo-Matic operates through a system of double acting valves which direct coolant properly, de-

Flo-Matic equipped UV-549 natural gas engine driving irrigation pump. New International system has gained wide acceptance for use on irrigation engines. Expansion tank is mounted on top of engine, heat exchanger is below engine base.

ANNOUNCE NEW CONVERTERS, CLUTCHES

IN line with a continuing program of product development, Rockford Clutch Division of Borg-Warner Corp., recently announced addition of a new line of torque converters and dual drive clutches. The torque converters were designed to handle loads from 100 to 700 horsepower and the new FA line of clutches has been specially designed to meet high speed engine requirements.



An infinite number of torque-speed ratios for off-highway vehicles, wheel and tracklaying tractors, load graders, rollers, stationary power units and industrial drives are provided by the torque converters. Torque multiplication ratios range from 2.3:1 to 3.5:1 in sizes ranging up to 18⅝ in. diameter. The converters are single stage, three element type with or without automatic overrunning reaction members for fluid coupling operation. The converters match Rockford's power shift hydraulic clutch line (See DIESEL AND GAS ENGINE PROGRESS, May, 1961).

All sizes attain high efficiency combined with high stall torque ratio. Smooth fluid velocity within the converters is maintained through reduced turbulence. Internal hydraulic thrust forces are self-contained and taken across two heavy duty roller thrust bearings. This allows ball bearings to become purely radial suports, thus contributing to longer converter life.

Especially suitable for power shift transmission applications, rotating and stationary housing

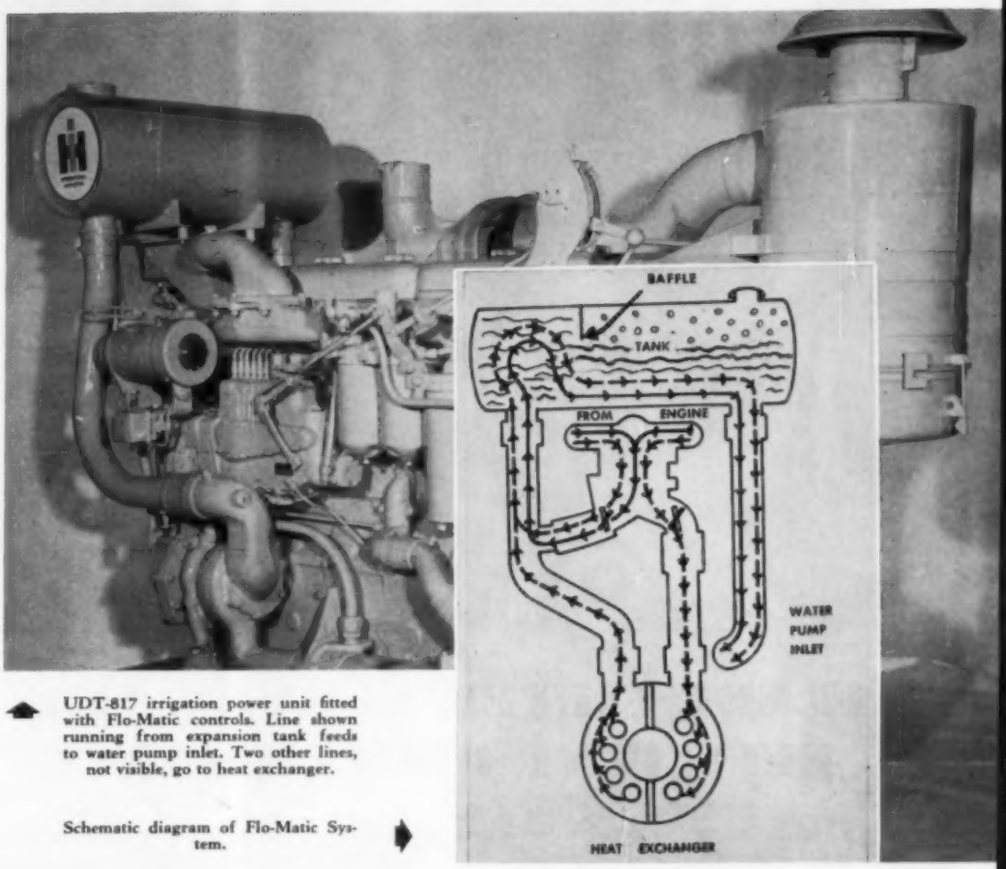
Cutaway view of typical new Rockford Torque converter.

E. R. Williams, sales manager, and Robert Jenkins, assembly foreman, inspect a partial shipment of Rockford torque converters. New converters are expected to find a variety of applications in 100 to 700 hp load range.

pending on the temperature of the engine. During warmup the valves direct coolant from the engines through a tank mounted above the front of the engine (in the case of the UD-817 series diesels) and back to the engine (see illustration). As the coolant temperature rises, valves move in unison, one starts to open and the other starts to close, to permit flow of greater amounts of coolant through the heat exchanger mounted at the engine base.

After engine warmup, the Flo-Matic control maintains coolant temperature automatically by modulating flow to the heat exchanger circuit while sustaining a full flow through the engine cooling system. The flow control valves are actuated by a Vernatherm unit which contains a temperature sensitive element capable of exerting the force necessary to adjust the valves as required by coolant temperature. No special coolant is required, only water and anti-freeze.

The Flo-Matic control is presently available for the UD-817 and UDT-817 diesel engines as well as several models of carbureted engines. The Flo-Matic attachment for the 817 series mounts directly on the engine. All other model engines utilize a common box-type base to support the expansion tank and piping. Tank and connections are designed to accommodate a left-hand or right-hand water pump inlet. The systems have been applied to applications as cotton gins, fire pumps, generator sets and deep well turbine and centrifugal irrigation pumps.



UDT-817 irrigation power unit fitted with Flo-Matic controls. Line shown running from expansion tank feeds to water pump inlet. Two other lines, not visible, go to heat exchanger.

Schematic diagram of Flo-Matic System.

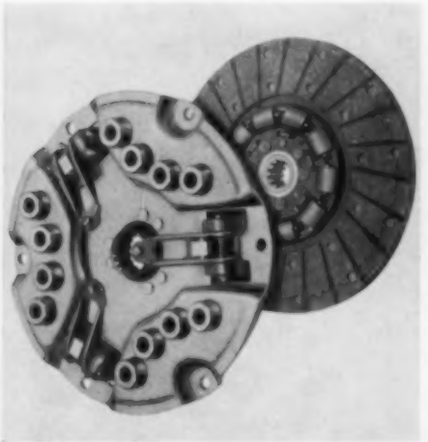
models are available. Drive can be direct spline to the flywheel or flexible rubber-drive coupling. The converters incorporate a high-capacity charging oil pump to satisfy power shift transmission requirements and insure adequate cooling oil flow. Cast aluminum impeller, turbine and stator are designed for efficient high speed operation. The converter can be adapted to various size flywheel housings. Free-wheeling stator, lock-up clutch, hydraulic break and governor drive are optional.

The spring-loaded FA clutch line is available for a variety of tractor drives. A counterbalanced release lever design permits high-speed operation without increasing pressure required to release and gives long bearing life. Rockford's patented anti-friction roller action of the release levers gives instantaneous disengagement with minimum pedal pressure and longer lever life. High strength, minimum inertia design gives high-speed operation without gear clashing or delayed shifting.

The dual drive clutches contain a built-in provision for live power takeoff. This auxiliary drive runs constantly from the flywheel through a splined hallow shaft. The new clutches have anti-rattle lever springs for quiet operation. Twelve engagement springs give maximum contact.

Through a choice of engagement springs and friction materials, the Rockford FA clutches are available in a wide range of torque capacities.

New dual-drive FA model clutches are now in production by Rockford Clutch Division, Borg-Warner Corp.



Hydraulic filter on Michigan 175A diesel loader is checked by survey specialist. He determines type of element required for survey records.

FLEET FILTER SURVEY AIDS EFFICIENT PERFORMANCE

RECOGNIZING that an operator's profit to a great degree depends on the reliable and economical performance of his engine-powered equipment, manufacturers today are continually extending and expanding their field service work. Along these lines is the fleet equipment filter service offered by Fram to owners and operators of any size fleet.

Basically, this service consists of a survey which lists all fleet equipment requiring lube oil, fuel, air and water filter elements. The value of these surveys is recognized by fleet owners who know that proper maintenance reduces downtime and costs to spell dollar savings.

Fleet men know the earning power of each piece depends on its being kept in service as long as possible with as little down time as necessary. And where this equipment operates in heavy dust areas as is the case when constructing highways, dams, bridges or moving mountains, it is of paramount importance that the engines' oil and fuel be kept contaminant-free and that all filters be serviced at regular, specified intervals established through manufacturer's recommendations as well as those of the Service Department, whose responsibility it is to keep the fleet running.

Fram maintains a staff of special technical sales representatives to perform surveys too wide in scope for the regular field sales representative in the area, whose time is ncessarily limited due to his many wholesaler calls. Initial contact is made by the field sales representative with proper officials of the fleet who show interest in the survey. He can either survey the fleet himself or turn the project over to the fleet specialists. These technical representatives will then perform the survey regardless of time required or wherever the equipment is located.

A typical case is that of the contractor who has been awarded a .ontract for road construction, flood control or hydroelectric dam erection. This operator may own or lease as many as 3,000 pieces of equipment, including rollers, dozers, shovels, rock crushers, compressors, drills, trucks, stationary diesels for power generation and a variety of other diesel and gasoline vehicles and equipment. In many instances there will be several makes of the same type of equipment and many pieces of the same make but different years, calling for entirely different models of the same filter, requiring different replacement cartridges. And unless the servicing personnel actually know each individual piece or remember each application, they must guess the type and model of cartridge needed or look it up in a service manual or ascertain it if the decal or printed label on the filter housing still remains.

However, if a fleet survey has been performed, service personnel have a complete record of the entire fleet's filter needs. Then they can refer to the particular piece in question and quickly locate the filter listed and the correct replacement cartridge needed. The fleet owner will immediately profit by the survey, as time spent in manual and catalog reading can be turned to valuable maintenance time.

As he lists each piece of equipment, the surveyor inspects the filter installation. He checks to determine whether the filter is the one installed as original factory equipment or one replaced by another brand. After checking each filter on the piece, the surveyor fills in a pressure sensitive fleet survey sticker and affixes it to some prominent place on the equipment. These labels are made out individually for each piece and provide space for listing the equipment number of each piece together with space for listing all filters such as lube, fuel (primary and secondary), air, transmission, steering, torque conversion, final drive, brakes, turbocharger, hydraulic.

The surveyor also lists all equipment on special forms either in numerical order if the equipment is so marked, or in its particular category such

Completed fleet survey record lists all equipment, correct elements for all filters installed on each machine.

Fleet survey specialist affixes special sticker on machine after listing all filter elements required on the unit.

as, all cranes, dozers, trucks, graders, compressors, etc. This form indicates the make, model and year of the engine concerned together with the makes and models of the lube, fuel, air and other filters with which each piece came equipped from the factory. It should be noted that this free survey service does not include just fleets alone, but all kinds of industrial machinery, railroad diesel engines, gasoline and diesel marine engines, generating plants, diesel and gas compressor stations, etc.

At the completion of each survey, the itemized listings are sent to Fram headquarters where they are typed, offset printing plates made, and enough copies printed to satisfy the fleet owner's needs, with several extra copies filed to meet future needs. The survey is completed by inserting each sheet into an acetate folder in proper page sequence to be bound in a Fleet Catalog folder, which will then include a copy of each of Fram's latest lube, fuel and air filter catalogs, with a cross reference listing all popular filters, and also a listing in alphabetical order of nearly all makes and models of trucks, passenger cars, construction equipment, farm tractors, etc., with the original equipment filter makes and models and the correct Fram replacement cartridge to be used. The name and address of the fleet surveyed is, of course, included on each survey heading, with the date when the survey was made.

Special post cards are provided each fleet surveyed, so that new equipment added to the fleet can be listed and mailed to Fram to keep the survey up to date. The completed copies of the survey are mailed either directly to the service superintendent or to the local field representative who will deliver them personally and offer any assistance needed. Other facets of the Fram Fleet Service available include cartridge and filter application wall charts to show the correct cartridge for every piece of equipment and printed fleet maintenance records. The industry has shown great enthusiasm over this fleet service and requests for this service have reached the Fram Sales Department from as far away as Japan.

SHOULD YOU PURCHASE DIESEL FUEL BY THE BTU?

By W. E. IRWIN*

CHANCES are you do not buy diesel fuel for so many cents per million Btu, since the standard unit for merchandising and pricing liquid fuels in this country is the gallon. It is not expected that this will change, although buying diesel fuel oil by the gallon is very much like buying bananas by the dozen—the real value of a gallon of fuel depends on its weight.

W. E. Irwin

The "work content" of a gallon of diesel fuel, or the Btu's (heat units) per gallon, is dependent on the weight of the fuel. Heavier fuels contain more Btu's, or work potential, for a given volume than lighter fuels. This is shown in Table I. It should be noted that the typical No. 2 diesel fuel has 7100 more Btu's per gallon than the typical No. 1 fuel. This represents over five per cent more potential work output.

TABLE I

Weight Fuel Lb./Gal.	Heat Value Btu/Gal.	Sp. Gravity at 60° F.	Gravity Deg. API
6.79*	134,700	0.816	42
6.95	137,000	0.835	38
7.29**	141,800	0.876	30
7.48	144,300	0.898	26

*Typical No. 1 Diesel Fuel

**Typical No. 2 Diesel Fuel or Furnace Oil

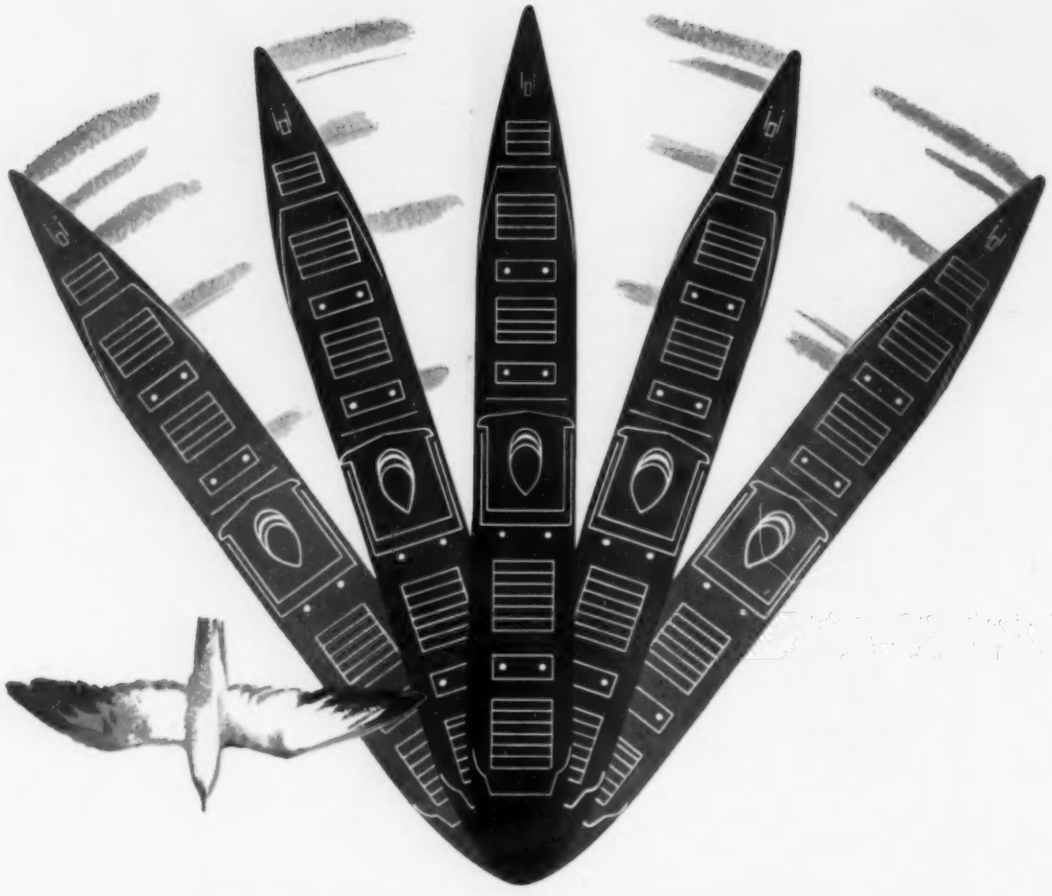
A fuel's weight is usually expressed in technical terms. Instead of simply saving the fuel weighs so many pounds per gallon at a given temperature, the weight is usually expressed as a specific gravity or an API gravity which has a direct arbitrary relationship to a specific gravity. The specific gravity of a fuel is the ratio of its weight to the weight of an equal volume of water at a given temperature. The arbitrary and empirical formula for calculating API gravity from specific gravity is such that the larger the API gravity number, the lighter the fuel—so don't be misled by API gravity numbers. This is illustrated in Table I.

The weight of fuel oil, or technically speaking, the specific gravity of the oil which represents the Btu content, can be measured with a hydrometer; a hydrometer being a float with a calibrated scale that is read at the surface of the liquid. Inexpensive but highly accurate, hydrometers are available having a scale marked in non-technical language that one can easily use to determine whether the fuel has a high, fair, or low Btu content. The hydrometer illustrated has a scale divided into three areas; the lower or green area indicating high Btu fuel, the middle or blue area represents fair or medium Btu content, and the top or red area relatively low Btu content.

For those technically minded, the lower (green) area has a small horizontal mark near the middle which represents a specific gravity of .866 at 75° F. This falls in the No. 2 fuel oil range. The upper horizontal mark near the middle of the top (or red) area represents a specific gravity of .816 at 75° F. This falls into the No. 1 fuel oil ranges. (The temperature of a fuel is moderately critical when being checked, since temperature affects the fuel's API gravity and the volume. Large volumes of fuel should be purchased to some standard temperature, usually 60° F. Other temperatures can be used as long as the temperature corrections are known; for example, 10,000 gal. of fuel at 80° F. is 9,920 gal. at 60° F.)

Diesel fuel hydrometer.

Mr. Irwin is manager of the service department, Industrial Engines, Caterpillar Tractor Co., Peoria, Ill.



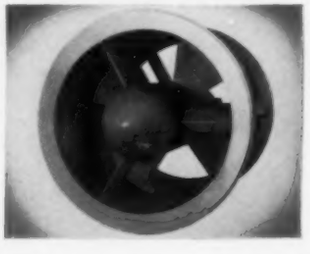
ANNOUNCING

the new KaMeWa BOW THRUSTER for the ultimate in precise maneuvering

Its design and operation are the combined results of 24 years of experience in building over 500 KaMeWa Controllable Pitch Propellers totalling over one million horsepower.

Its optimum hydrodynamic design is based on extensive model testing plus several years of operating experience.

Write for complete information. Address Department DP, Bird-Johnson Company, South Walpole, Massachusetts



KaMeWa Controllable Pitch **BOW THRUSTER**

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Sales Office: 21 West St., New York 6, New York
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GAS TURBINE PROGRESS

A MONTHLY SUPPLEMENT TO DIESEL AND GAS ENGINE PROGRESS REPORTING ON NEW DEVELOPMENTS AND APPLICATIONS IN THE TURBINE POWER FIELD

Perfect Circle Acquires Turbine Parts Firm

Agreement on the acquisition of Schellens True Corp. of Ivoryton, Conn., by Perfect Circle Corp., Hagerstown, Ind., was announced by W. B. Prosser, president of Perfect Circle, and E. L. Schellens, president of Schellens True. In commenting on the acquisition, Mr. Prosser stated that Perfect Circle has long been interested in participating in the development of turbine engines. "We now have not only the opportunity to expand into this rapidly growing field," Mr. Prosser stated, "but also we have complete confidence in the capabilities of the people at Schellens True." Schellens True produces turbine blades and turbine wheels for gas and steam turbines, compressors, blowers, pumps, and auxiliary equipment. The company's products are used in jet engines and missiles, as well as in industrial applications. Immediate expansion of Schellens True facilities is anticipated. Present facilities are now operating at full capacity. Schellens True will become a wholly-owned subsidiary of Perfect Circle and will be operated by the present Schellens True management.

REA Texas Loan

The Rural Electrification Administration has announced that the South Texas Electric Cooperative, Gonzales, Tex., has been granted a $14,683,000 loan to finance construction of a generation and transmission system, consisting of: a 44,000 kw generating plant in the vicinity of Goliad; and 833 miles of transmission line and substation facilities with total capacity of 91,000 kva. These facilities will enable the borrower to provide an adequate and dependable supply of wholesale power to six distribution cooperatives, making up the membership of the borrower. The new transmission system, consisting of 741 miles of 69 kilovolt and 92 miles of 24.9 kv line, will tie together nearly all of the load centers of the six member co-ops. In addition, the transmission network will be inter-connected with the Medina Electric Cooperative east of its Pearsall plant. Initial power for the South Texas system will be delivered from the Pearsall plant. In 1963 this power will be supplemented by installation of an 11,000 kilowatt gas turbine generator at Goliad, and in 1964 by a second 11,000 kw gas turbine unit at the same location. Balance of the 44,000 kw will be added by 1965.

Onboard Turbine Order

Orders for onboard small gas turbines for two new European aircraft have been announced by The Garrett Corporation's AiResearch Manufacturing Division. AiResearch turbines will be placed aboard both the German-French C-160 Transall, and the French 1150 Atlantique. These installations will mark the first use of onboard auxiliary turbines on foreign military aircraft. The Transall is an assault transport, jointly built by Nord Aviation, France, and West Germany's Weser-Flugzeugbau. The Atlantique, which will serve as a NATO patrol craft, is being built in France by Avions Louis Breguet. Both are turboprop aircraft. To be delivered are AiResearch combination pneumatic and shaft power turbines. The units will supply ground and in-flight auxiliary hydraulic and electrical power for both aircraft. Potential production for both new European aircraft is believed to total over 300, nearly two-thirds of this for the C-160.

Turbine Silencing Booklet

Gas turbine noise problems are discussed in a new booklet published by the Koppers Co. The 12 page booklet examines the problems and requirements of turbine exhaust silencing, shows diagrams of baffles and silencers and discusses "Ten Steps to Silencing Your Gas Turbine." Also included are a work sheet and graphs and tables to aid in determining silencing requirements. For a copy of "Gas Turbine Silencers," write the Koppers Co., Metal Products Division, Industrial Sound Control Dept., Box 298, Baltimore 3, Md. (ITS NEW)

Wyman-Gordon Organizes Gas Turbine Product Group

Although forged crankshafts continue to be the chief contribution of Wyman-Gordon Co. to the automotive industries, that company is prepared for any developments in the manufacture of gas turbines for vehicular, industrial and marine applications. "When the industry is ready for forged gas turbine components, they will find that in research, development, technological know-how and production capabilities, Wyman-Gordon is ready as the result of work long advanced in space and aircraft requirements," James L. Roach, vice-president and director of marketing said. At its home plant in Worcester, Mass. and at its USAF-leased plant at North Grafton, Mass., the company is engaged in the production of gas turbine wheels, shafts, hubs, and other components for missiles, rockets, and aircraft and this month organized a special product sales group to concentrate on commercial as well as military gas turbine applications. Currently, the bulk of such sales is for military use, Roach said, but the company is aware and prepared for the potential in prime power movers. At the Society for Automotive Engineers Show in Detroit, the company exhibited small turbine wheels in a variety of shapes, configurations and materials indicative of its capabilities in producing forgings for applications involving service temperatures from 800° F. to 1600° F. These have been forged from source materials ranging from Type 430 Stainless Steel to Astroloy.

Turbines For Tug-Fireboat

Boeing gas turbines will provide pumping power for a dual purpose 100 ft. ocean-going tug-fireboat being converted for use by the United States Army Transportation Corps. The Boeing Industrial Products Division has received an Army contract to supply two gas turbine-driven pumping units each rated at 2,000 gpm at 150 psi. Each pump will be driven by a Boeing 502-10MA gas turbine engine rated at 270 shaft horsepower. The pumps are of the close-coupled single-stage centrifugal type, with 8 in. suction and 8 in. discharge. After the conversion of the Army tugboat to the tug-fireboat combination, the vessel will be able to tow at full power while pumping at full capacity. It will be based at Wilmington, N.C. Automatic pressure controls will enable the unit to pump at any preselected pressure up to 250 psi without manual adjustment, regardless of the number of firefighting hoses or monitors on the line. One pumping unit will be installed on each side of the engine room. Each pump draws from individual sea chests which are extra large and interconnected. The turbine exhaust will be ducted ino the tug's main stack. The new turbine pumping installation is expected to be completed by mid-summer 1961. The turbines will be built to standards of the American Bureau of Shipping.

PRATT & WHITNEY'S INDUSTRIAL GAS TURBINES

By ROBERT E. SCHULZ

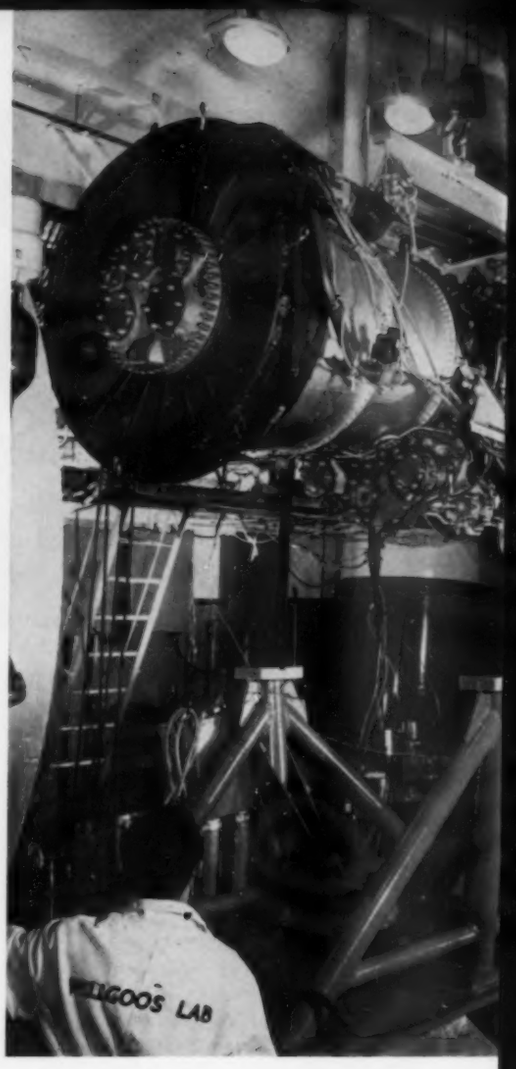
IN East Hartford, Conn., the newly formed Industrial Power Department of Pratt & Whitney Aircraft has a sound, down to earth program underway in the development and application of its aircraft gas turbines to oil field servicing, gas gathering and transmission, electric utility peaking, and marine propulsion. The department, headed by Manager William J. Closs, has assigned four engines from its overall turbine group for industrialization: the 2500 hp FT-12 (JT-12); 7000 hp FT-8 (J-52); 10,500 hp FT-3 (J-57) and the 15,000 hp FT-4 (J-75). Expected addition to this line in late 1962 is the ST-6, a 350 hp turbine engine now in development and test phases.

As most of our readers know, the first of the P&WA turbines to enter industrial service was a modified J-57 which was adapted to burn natural gas. This gas generator, coupled to a Cooper-Bessemer power turbine—in a package called the RT-248—was installed last fall at the Clementsville, Ky., station of Columbia Gas Transmission Co. (See D&GEP Nov. '59 and Jan. '61 issues). Rated 10,500 hp, the RT-248 drives a Cooper-Bessemer centrifugal gas compressor. Frequently, the unit has taken the entire throughput at the station and output on occasion has been as high as 11,950 hp.

Early in spring, Pratt & Whitney Aircraft announced the second industrial application of the J-57, now designated the FT-3, to drive a generator set to be installed by Hartford Electric Light Co. in that city's South Meadow section. Expected to be operational by early 1962, the 8 to 10,000 kw plant will augment the utility's large steam-operated plants. The complete power package will be fully automated and housed in a small sound-proofed structure. The FT-3 will incorporate a two-stage P&WA power turbine which in turn will drive a direct-connected 3600 rpm generator. It is anticipated that the unit will come to full load and synchronous speed in approx. two minutes.

Three of the four members of the present P&WA industrial gas turbine family are twin spool compressor engines. The FT-12 is a single spool compressor engine. The FT-3, for example, has a 9-stage axial low pressure compressor and 7-stage axial high pressure compressor. Each compressor is driven by its own turbine and operates at different speeds. Shafting on the twin spool models is concentric and a small motor drives the high pressure shaft in starting. Compression ratios are 10:1 for industrial rating and 12:1 for aircraft applications. These are important factors in the high efficiency achieved by these engines without regenerator.

Looking at the following ratings, these efficiencies apply: continuous—25%; intermittent—27%; maximum—29%.

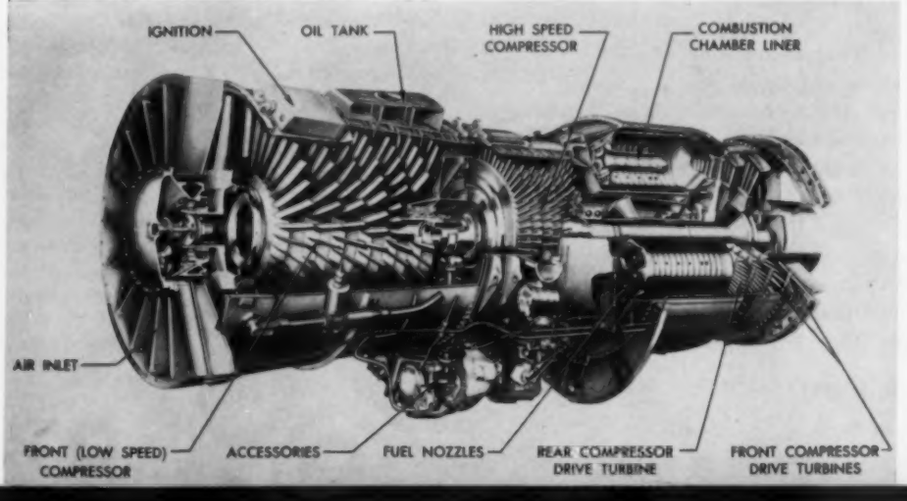


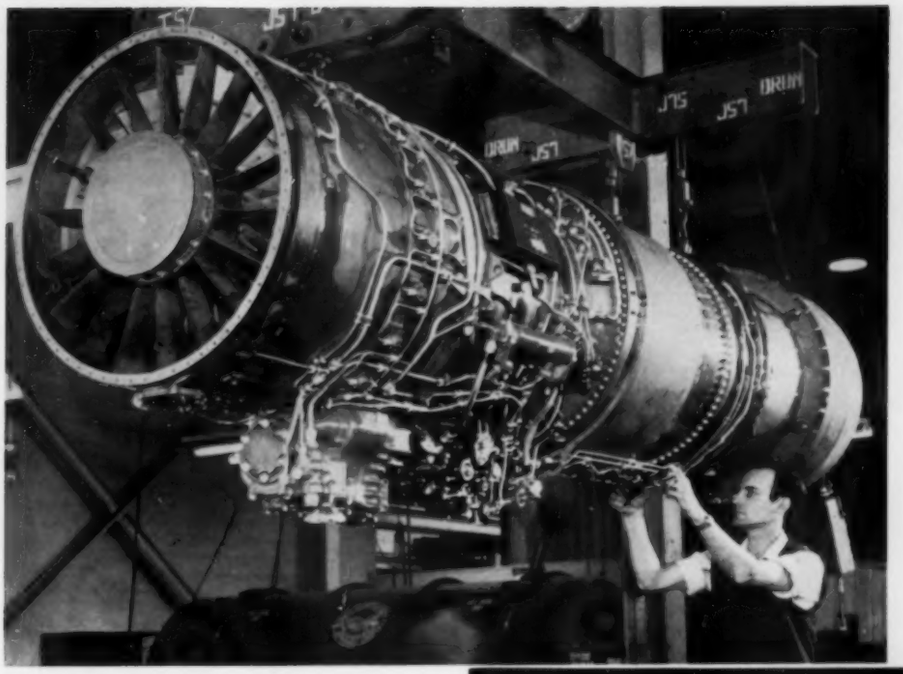
Model	Max.	HP Rating Int.	Cont.	KW Rating	Weight
FT-3	20,000	13,300	10,500	10,000	12,000 lbs.
FT-4	30,000	20,000	15,000	15,000	15,000 lbs.
FT-8	15,000	9,300	7,000	7,000	9,000 lbs.

Approximately 22,000 of these engines have been built in gas turbine, turbo jet, or turbo-propeller types totalling about 500 million horsepower. P&WA believes these engines offer three general categories of advantages for industrial applications. One, they offer low initial cost and experience thus far shows low operation and maintenance costs as well. Two, in the area of operation, they are adaptable to numerous installations with high availability, short changeover time in the event of forced or scheduled outages and can operate under

ST-6 is 350 hp turbine engine in development and test phases. It is expected to be ready for addition to the P&WA line in 1962.

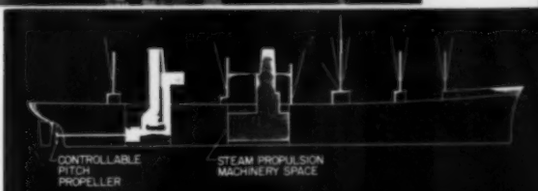
Cutaway of FT-4 turbine engine. This turbojet, when modified for industrial applications is rated 15,000 cont. hp and 30,000 max. hp.





FT-8 gas generator turbine is readied for shipment. FT-8 is industrial version of J-52 aircraft turbine, is rated 7,000 cont. hp.

10,500 hp FT-3 gas generator is lowered into place for testing with free power turbine. This unit, industrial version of J-57 aircraft engine, has been packaged with Cooper-Bessemer power turbine and is installed at Clementsville Ky., station of Columbia Gas Transmission Co.



COMPARISON OF SHIP PROPULSION POWER PLANTS

	GAS TURBINE	STEAM TURBINE
MAX CONTINUOUS HORSEPOWER	20,000 HP	19250 HP
TOTAL MACHINERY WEIGHT	588 LONG TONS	1040 LONG TONS
MACHINERY SPACE	80,000 CU FT	176,000 CU FT
GAIN IN CARGO SPACE	12 %	—
LENGTH OF SHAFTING	75 FT	190 FT
CAPITAL INVESTMENT	$3,000,000	$3,700,000

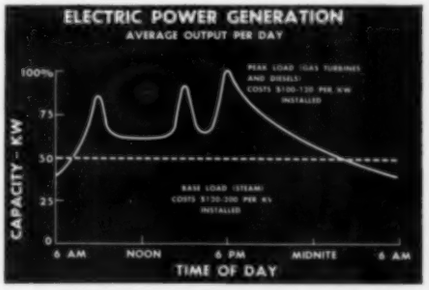
Gas turbine vs steam turbine (mariner class ship)

extremes of climatic conditions. Thirdly, due to their light weight and compact size, they are easily transportable. This makes them well suited to mobile uses, and on the maintenance side they are readily transportable on an exchange basis for overhaul by the manufacturer. Looking at the Clementsville-Columbia Gulf installation for a moment, the turbine thus far is measuring well up to expectations—especially considering it is the pilot installation. With the unit performing well, general inspection, originally planned for 1,000 hrs., was moved up to 2,000 hrs. At 1,186 hrs. a blade on the power turbine failed, causing automatic shut-down. With repairs required, P&WA took advantage of the opportunity and flew the unit back to East Hartford. Dismantling and inspection revealed only a cracked carbon-type seal. The jet engine was then reassembled without overhaul, tested, and shipped back to Clementsville. After an additional 416 hrs., the reinforced diffuser between the engine and power turbine cracked and this was immediately replaced. Since that time, the turbine has been rolling right along. Operating hours were in excess of 2,670 hrs. in mid-May. The unit is meeting the dynamometer test rating of 25 per cent thermal efficiency and oil consumption is less than .10 gals./hr.

As was pointed out earlier in this article, the gas turbine has potential in a number of different industries such as oil well fracturing, electric power generation, gas gathering, etc. In addition, the anticipated long life of this power plant, which is yet to be fully demonstrated for industrial application, is attractive to the chemical, oil refining and paper industries as a source of hot gas and heat as well as power for combined cycle operation. As an example, there have been numerous studies made by industrial firms to utilize the gas turbine as a prime mover driving a generator or blower and to utilize its high temperature waste heat gases for process use or to generate low pressure steam by means of a waste heat boiler for general plant use.

In the field of marine propulsion there is a potential power market which high efficiency, reliable and low capital cost gas turbines can penetrate in time, especially as gas turbines are developed to a state where they are able to burn low cost fuel, such as Nos. 4, 5, and 6 (Bunker "C") oils. P&WA has already made a study for the Maritime Commission to determine the advantages of gas turbines for merchant class ships, and the results of such a study on a large Mariner class merchant ship are illustrated. This study indicated that a gas turbine power plant with a controllable pitch propeller would reduce the power plant weight, volume, and length of shafting by approximately 50 per cent, increase the cargo space by 12 per cent and decrease the capital investment by approximately 20 per cent.

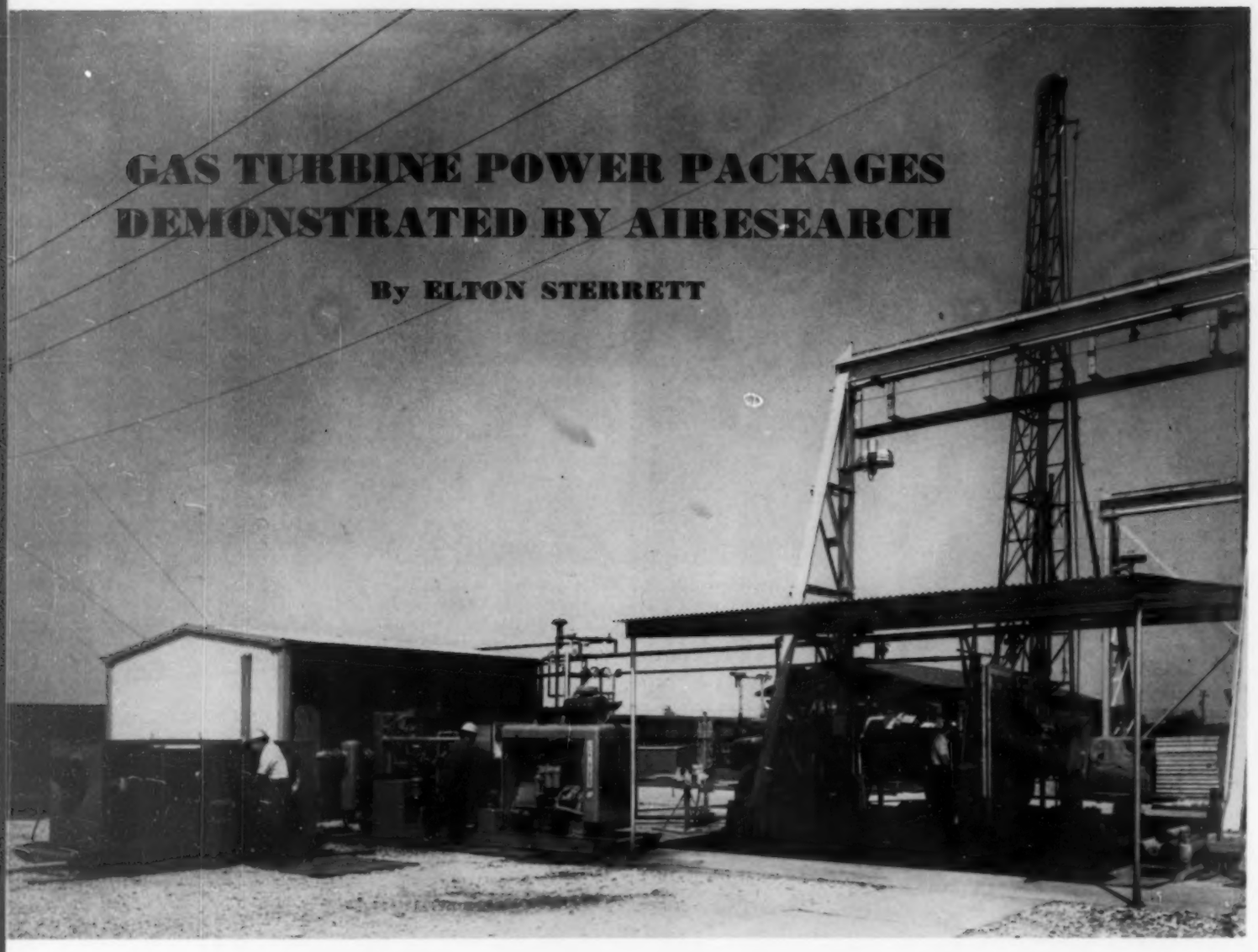
Detailed studies are continuing to further explore gas turbine propulsion in conjunction with partially and fully automated ships for the purpose of improving the operating efficiency of tankers and cargo ships and to reduce shipping costs. Similar studies are also underway with the United States Navy to determine how gas turbine drives can most effectively improve the performance of naval vessels for high speed, military operations in both the hydrofoil and conventional hull craft.



Typical peak power curve (electric power generation average output per day)

GAS TURBINE POWER PACKAGES DEMONSTRATED BY AIRESEARCH

By ELTON STERRETT



PACKAGED gas turbine power, in units from 160 to 650 hp, was demonstrated at the new plant of Mission Manufacturing Co., Houston. Employing the range of small turbines manufactured by AiResearch Manufacturing Co., a division of Garrett Corp., practicability of this type of prime mover was emphasized to groups of petroleum and other industry engineers.

For the tests, standard AiResearch units consisting of combustion turbine compressor and power unit—skid-mounted—with heat exchanger, operating controls and safety devices, were employed. A fully automatic control system properly sequences starter operation, fuel control, and ignition to provide a stable automatic starting cycle requiring manipulation of only a single starting switch.

One unit was shown as power source for a sand-blasting rig. Bleed air, drawn from the turbine compressor system, is cooled and fed into a standard sand-blast trunk hose, into which is air-fed sand from a hopper mounted on the same base as the turbine. The 160 hp turbine, weighing 190 lbs., was started at the touch of a button, and within a few seconds air and sand were available at the blast nozzle. Although exhausting through a vertically mounted expanding ell, the noise level, once the turbine reached full power, was surprisingly low.

Another demonstration involved the same horsepower turbine, connected to a Mission centrifugal pump through a planetary gear train carried within the unit's flywheel. With this drive the pump, normally operated at 2700 rpm, was spun at 6000 rpm, giving more than twice the original design volume of water, at more than three times the pressure. For fire-fighting units, such combustion turbine power offers a light, almost instantly available source of high-pressure water. In the demonstration, under prevailing wind conditions, the high-pressure water jets issuing from the pair of nozzles and reaching 100 ft. in the air, made such a fog in falling that it was almost impossible to get clear photographs of the jets.

A third demonstration emphasized the effectiveness of the small combustion turbine in oil-well drilling operations. An air-hammer drilling unit

was used to demonstrate the effectiveness of the company's system of drilling as well as that of the turbine as a source of primary air. The initial compression of the air was accomplished with a 650 hp AiResearch turbine, its power shaft turning the impeller of a small booster compressor which delivered air—bleed air from the turbine compressor—at 105 psi. This air, led through the compressor of a skid-mounted internal combustion engine compressor unit, was boosted to 350 psi for delivery to the drilling rig, where it actuated the hammer drill, the drawworks, and all auxiliaries of the rig. On a test through a block of granite, the rig made a 12¼ in. hole at the rate of 21 ft. an hour, or more than four times the rate considered maximum with conventional rotary drilling. The compressor-turbine unit, exclusive of the skid mounting and weather housing, weighs 400 lbs.; the entire unit as utilized in the test weighed only 4010 lbs.

Other combustion turbine demonstration units included a 160 hp turbine equipped with armored hose for feeding bleed air into the scraper trap or end of line for driving a "pig" or pipe cleaner through transmission lines for removing scale, dirt or water and other liquids. This unit was not demonstrated, due to the difficulty of setting up a trap to reclaim the scraper after such a short traverse through the line. Similar units have seen service in pipeline construction and maintenance, the 105 lb. pressure available at the turbine being sufficient to push the scraper through the line at optimum speeds. Still another unit incorporated the 160 hp unit totally encased and mounted on wheels to provide a power source that can be readily transported.

Stationary (not hooked up for running tests) units included AiResearch's smallest complete turbine unit, rated at 50 hp and weighing 59 lbs.; a cut-away model to show the relatively small number of rotating or moving parts; and other models up to the 650 hp unit used as primary air compressor for the air-hammer drilling rig.

AiResearch Manufacturing Co. has pioneered in development of lightweight, small horsepower turbines, and with a record of more than 10,000 such units already in service, will manufacture the turbines shown at the demonstration. Mission Manufacturing Co. will package the combustion turbine units for utilization by the oil industry and by other industries which already have developed applications for such power units, or which may envision possible uses following the series of demonstrations at the Mission plant.

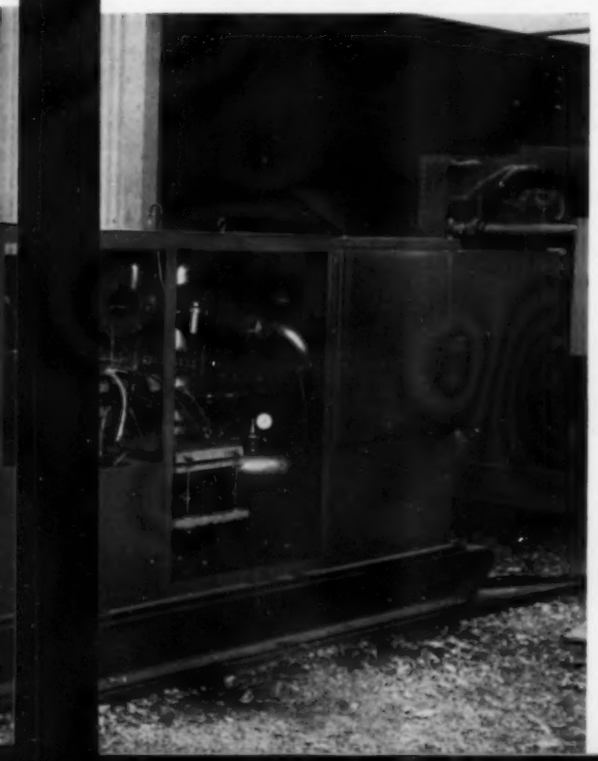
The advantages of ready portability—weights on the order of a pound per horsepower in the smaller units and half that amount in the larger turbines—coupled with instant availability of power and the ability to operate on a wide choice of fuels; all these combined to win the small combustion turbine consideration as power source for industrial applications both in field and factory installations.

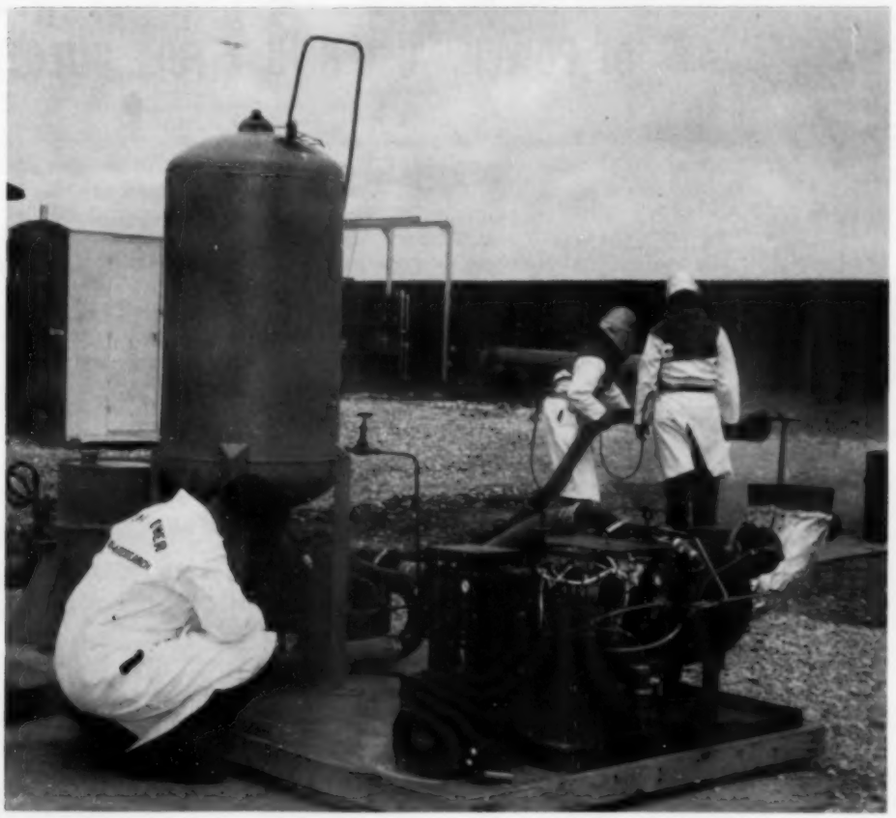
A 160 hp AiResearch turbine, connected through planetary gearing to Mission centrifugal pump. The pump, designed for operation at 2700 rpm, at the 6,000 rpm speed given it by the turbine gearing, more than doubles throughput and steps up pressures to three times the earlier rating.

Mounted with air-cooler and sand tank, this unit, rated 160 hp serves as sand-blasting power, the blast air being bled from the turbine compressor system, cooled, and powering blast hose.

Over-all view of air-hammer drilling rig. At left the 650 hp turbine, with the second-stage compressor, driven by Allis-Chalmers engine, next in line. Power air, at 300 psi is led to the drilling rig, operates drilling hammer, drawworks, all drilling auxiliaries. Use of turbine as primary air source eliminates two or more air compressors of conventional type.

The AiResearch 650 hp turbine, here with booster compressor driven from turbine shaft, provides air for air-hammer drilling. Bleed air, taken from turbine compressor and pressurized to 105 psi, is fed to intake of second-stage compressor for operating rig.





John Deere "3010" Diesel Row-Crop Utility with integral or pickup plow.

JOHN DEERE DIESEL TRACTORS, IN "NEW GENERATION OF POWER," USE BENDIX FUEL INJECTION NOZZLES

John Deere's newest line of farm tractors, featuring what the company calls a "New Generation of Power," promises a brighter, more profitable future for farmers. To meet the special needs of large-acreage, row-crop farming, Deere has engineered its tractors for more complete control over work time and quality, operating cost, and physical effort.

Features designed to achieve these aims include: New multi-speed Synchro-Range transmission that "tailors" speed and power; demand-type hydraulic system that provides finger-tip equipment control, as well as supplying the power steering and power brakes—the latter a new John Deere "first"; new independent dual-speed power take-off for 540 and 1000 rpm equipment; scientifically designed posture seat.

John Deere builds both 4- and 6-cylinder variable speed engines, in gasoline, diesel and LP-Gas models. On its diesel-powered tractors, Deere uses Bendix® Fuel Nozzles for efficient, dependable diesel fuel injection, with maximum utility and minimum maintenance.

In greater and greater numbers, engine builders rely on Bendix for their needs in diesel fuel injection equipment. Users, too, are assured of continuing satisfaction through our nation-wide organization of distributors and service specialists. When you think of diesel fuel injection equipment, think of Bendix!

Scintilla Division
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The Bendix Corporation

Export Sales & Service: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

Heads E-M Control Division

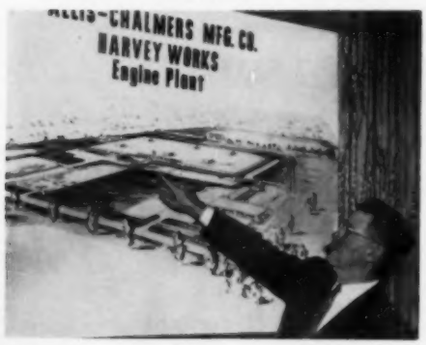
R. J. Mullenbach

Robert J. Mullenbach has been appointed general manager of the Electric Machinery Mfg. Co., Control Division. Mr. Mullenbach will be responsible for all activities of the new division, including engineering, manufacturing and sales. The Control Division is responsible for the manufacturing of controls for motors and generators, static power converters and industrial control systems.

A-C Engine Plant Near Completion

Construction of Allis-Chalmers huge multi-million dollar engine manufacturing plant at its Harvey, (Ill.) Works has been virtually completed. Initial production of Allis-Chalmers line of nine basic diesel and gasoline engines is expected to get underway in the new facility about July 1. Later in the year the new plant will absorb production of six other engine models used in the company's line of material handling trucks, also manufactured at Harvey. Located next to Allis-Chalmers' recently completed engineering development and research laboratory, the new plant houses 515,000 sq. ft. of floor area. It is 1,100 ft. long and 440 ft. wide. Plant grounds occupy 35 acres of land acquired by the company in 1957. A-C engines are used to power many products of the company sold in the construction machinery, farm equipment and material handling fields. Commercially, Allis-Chalmers supplies engines to such industries as construction, marine, oil fields, irrigation, logging, transportation and in those industries using the stationary and portable engine-driven diesel electric generator sets Harvey Works produces. The new plant will employ a straight line production system in the machining and assembly of engines. The Harvey Works became a part of Allis-Chalmers on November 1, 1953 and was formerly known as The Buda Co. The present works in addition to the research laboratory is made up of two other plant facilities in Harvey and has approximately 654,000 sq. ft. of floor space. (A full feature article will be carried in DIESEL AND GAS ENGINE PROGRESS in the next few months.)

Pointing to Allis-Chalmers new multi-million dollar engine manufacturing plant at Harvey, Ill., is Owen Higgins, general manager of the firm's Harvey Works.



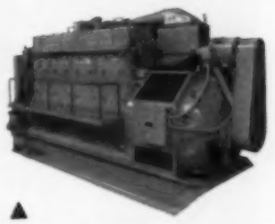
Atlas Missile as it clears the pad.

Engine exhaust heat, recovered by Vapor Phase® Waste Heat Recovery Silencers on White Diesels, is utilized in the latest design of ICBM sites. Cost of operation is reduced substantially by using this energy in various ways to supplement generated power.

In other applications, engine heat from jacket water and exhaust is recovered for space heating, product heating and with absorption refrigeration for air conditioning.

In addition to these advantages, Vapor Phase systems permit the use of cheaper fuel. Engine wear is reduced and you can lengthen the time between overhauls.

Wherever engines are used, Vapor Phase® can improve efficiency and add economy.



White Superior Engine-Generator Model 40-SX-80 used at Atlas Missile Bases.

Vapor Phase Exhaust Waste Heat Recovery Silencer designed for use with the Superior Engine-Generators used by the Air Force at Missile sites.

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COSTLY DUST PROBLEM SOLVED BY DRILLING COMPANY WITH PUROLATOR 2-STAGE DRY-TYPE AIR FILTERS

First-stage Micronic® element of Purolator 2-stage air filter being replaced by New Jersey Drilling Co. Foreman, Dick Hompesch. One of the nation's biggest drilling outfits, New Jersey Drilling uses Purolator 2-stage filters to protect all its motive equipment.

Four ruined diesels prompt quick switch to Purolator 2-stage dry-type filters with built-in double protection.

"A lot of abrasive silica dust passed right through our old single-element filters and completely ruined four drilling-rig diesels," reports Emil McConnel, New Jersey Drilling Co. VP.

"The extra protection offered by a second filter element sold us on the idea of switching to Purolator 2-stage air filters. Performance has been completely satisfactory. These filters now protect all our motive equipment."

Why Purolator 2-stage filters give complete protection.

Purolator's 2-stage air filters offer extremely high performance because they contain two Micronic® filter elements — each operating independently. If one element should get out of order, the other keeps on removing 99.98% of all contaminates. Harmful abrasives never get into the engine—no matter how dirty the job.

Easy, quick maintenance.

Servicing the 2-stage filter takes only minutes. After housing cover is removed, used element is lifted out and replaced with a new one. First-stage element lasts up to 2,000 hours. Second-stage element should last almost indefinitely.

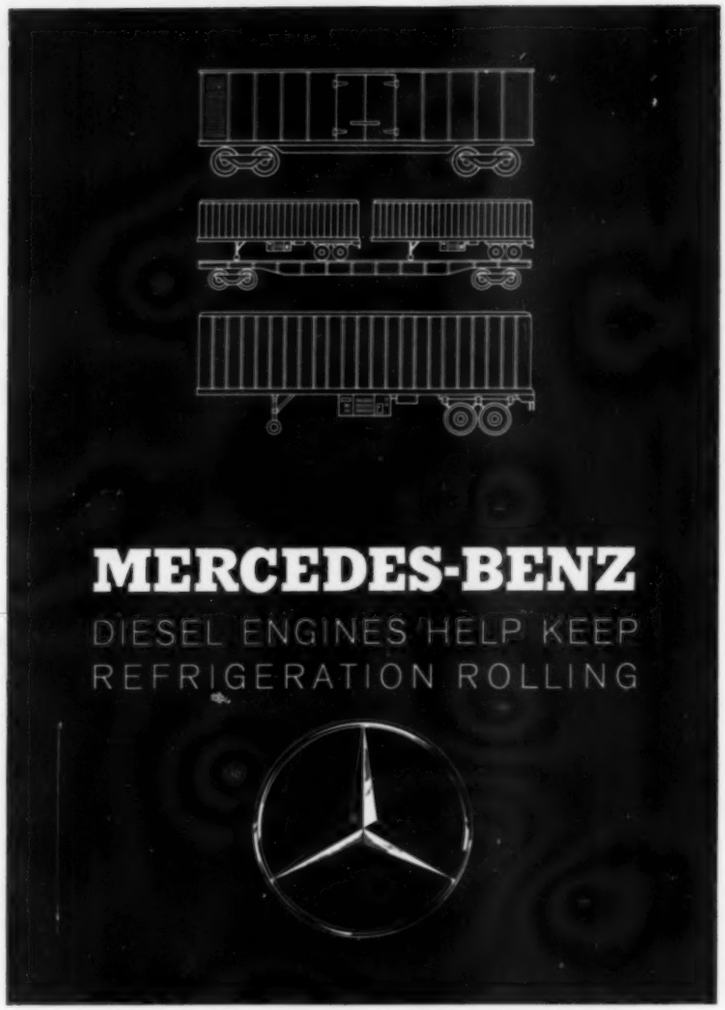
For complete details on the 2-stage, dry-type air filter, write: Purolator Products, Inc., Dept. 7137, Rahway, N. J.

Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, CANADA



Light, quiet, compact and economical to operate, Mercedes-Benz diesel engines are adaptable to both direct mechanical and electro-mechanical refrigeration. Manufacturers and designers seeking refrigeration units intended for railroad cars, unitized containers, and truck and piggy-back trailers will find a seasoned team of Mercedes-Benz specialists in sales, engineering, service and supply, ready to work with them from the planning stage on. The finished product will not only have the utmost in economical and dependable diesel power but the assured acceptance of Mercedes-Benz quality. **MERCEDES-BENZ DIESEL ENGINES—A PRICE-QUALITY STANDARD SECOND TO NONE.**

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Heads Planning Service

The Detroit Diesel Engine Division of General Motors has appointed Ralph Pontius, former regional service manager at San Francisco, head of its Distributor Facility Planning Section at the factory in Detroit. Pontius will offer increased assistance to GM Diesel distributors and dealers in planning new buildings or reorganizing existing facilities for maximum shop efficiency. The service is aimed at the adoption and arrangement of facilities proven most effective in servicing engines in all types of vehicular, industrial, construction and marine installations. Available at distributor request, it includes factory assistance in the selection of new locations, new building design, selection and layout of tools and equipment and cooperation in planning every phase of the service activity.

Special Diesels For Brazil

A $750,000 generating plant for the Brazilian city of Fortaleza was inaugurated on April 17. With an exploding population and ever-growing electricity demands, officials of the city in Brazil's Ceara province found themselves faced with the problem of an abundance of heavy crude oil from the local refinery, but no diesel generating sets capable of using it efficiently. Wear research in a radioactive cylinder at the Fairbanks, Morse plant in Beloit, Wis., showed that the company's large opposed-piston diesel generating sets could operate on the extremely viscous crude oil (almost a petroleum jelly), without excessive down-time for maintenance. To accomplish this, special pre-heating, filtering and centrifuging equipment had to be provided by Fairbanks, Morse. The generating plant uses four Fairbanks-Morse Model 38D8—⅛ opposed-piston diesel generating sets to provide an output in excess of 5600 kw.

Turbine-Compressor Sets for Trans-Canada Line

Clark Bros. Co., has delivered three gas turbine-centrifugal compressor sets to Trans-Canada Pipe Lines Ltd. to power three new compressor stations in the latter's multi-million dollar expansion program to export natural gas to the United States. The turbines are Clark model 305 regenerative cycle, two shaft machines rated at 8370 hp each (at NEMA conditions). They will drive Clark 30 in. x 30 in. single stage centrifugal pipeline compressors which will pump approximately 700 million cubic feet of gas per day through the natural gas pipeline. The Clark turbine compressor sets will be located in three new compressor stations which are being added to the western portion of the Trans Canada line running through the southern part of Saskatchewan. The stations, located near Cabri, Herbert and Regina are spaced between existing compressor stations powered by Clark model TLA-10, 3400 bhp reciprocating gas-engine-driven compressors. The turbine driven centrifugal compressors have been equipped with specially designed control systems.

Diamond T Brochure

An illustrated, full-color four-page brochure on the new 990 diesel series is now available to interested operators from Diamond T Motor Truck Co. It contains a full description, specifications and ratings of two-axle vehicles as well as extra-heavy-duty six-wheelers. For a copy of the brochure, write: Diamond T Motor Truck Co., 4401 W. 26th St., Chicago 23, Ill.

Lipe Sales Engineer

Forrest D. Thomas has been appointed midwest sales engineer by the Lipe-Rollway Corp., Syracuse, N.Y., manufacturer of heavy-duty clutches. He will replace Thomas Kenny who is retiring.

How United Motors Service helps you get better fleet performance from your Delco-Remy equipment

It's as easy as . . .

HELP FROM 39 UMS ZONE SERVICE MANAGERS (see list at right above), providing on-the-spot advice and recommendations on questions involving Delco-Remy equipment.

HELP FROM DELCO-REMY SERVICE MANUALS that give step-by-step analyses of typical maintenance and trouble-shooting procedures. Available from UMS distributors, these manuals make service faster, easier.

Mid-West Diesel News

By **L. H. Houck**

NEW equipment added recently by Fruin-Colnon-Utah, for Union Electric's $50 million pumped storage plant near Lesterville, Mo., include four Caterpillar D8's, a 1055 P&H with P&H diesel, four 27-ton Euclids with GM 6-110's and a couple of Ingersoll-Rand Gyro-Flo 600's with GM diesels.

EUCLID-Mississippi, Jackson, Miss., has been appointed distributor for Baldwin-Lima-Hamilton Corp., and Euclid-Knoxville, Knoxville, Tenn., will handle same lines, providing sales and service for Lima shovels and cranes.

FORAL Motor Sales, Lena, Wis., has installed a GM 4-53 diesel in a Ford 750 delivery truck. Sale by Inland GM Diesel, Inc., Milwaukee.

CITY of Green Bay, Wis., a GM 3-53 industrial power unit from Inland for use on their sewer servicing equipment.

WALTER B. Rom & Son, GM 4-71 for repowering a Bucyrus-Erie water well drill, from Inland, Milwaukee.

NEW Unit crane and shovel dealer in St. Louis area, Hennessey-Forrestal Machinery Co. Unit's offer diesel engines of several makes and range from ½ to 1 yd., 6 to 22 tons and truck cranes from 10 to 40 tons.

SPEEDWAY Transports, Inc., Kenosha, Wis., has installed another GM 3-53 from Inland in a Ford F-700 truck.

CONTINENTAL Transportation Lines, Inc., McKees Rocks, Pa., has added 10 Mack B67T diesel tractors to its fleet. Mack also announced six B61LT diesel tractors to Van Rompaye Trucking Corp., Chester, N. Y.

ON display for 6 hours in Jefferson City, Mo., Continental Trailways Five-Star Golden Eagle luxury bus, New York to Los Angeles. Engine is 350 hp Cummins diesel. Bus has observation lounge, hostesses, hot meals, free newspapers, card tables and other revolutionary comforts.

TRI-STATE Equipment Co., Inc., Memphis, is a new Allis-Chalmers dealer, serving parts of Tennessee, Arkansas and Mississippi. Clark Equipment Co., is a new Arkansas Allis-Chalmers dealer in Little Rock.

WHITEHOUSE Engineering Co., Carpentersville, Ill., has recently added a 100 hp 955H Caterpillar Traxcavator, a Caterpillar D7 and a No. 70 Caterpillar scraper to its equipment fleet.

TWO GM diesel power units, model 6031C and 3031C, delivered to Aring Equipment Co., Milwaukee for installation in a Barber-Greene asphalt plant for the Ozaukee County highway department.

HUGHES Bros. Service, Inc., Marshfield, Wis., a GM 6V-53 truck engine from Inland GM Diesel, Inc., Milwaukee, for installation in a GMC LWV 5500 truck.

MARTIN-Roasa Tractor & Equip. Co., Cedar Rapids, Iowa, has been named Allis-Chalmers engine dealer. Company has a branch at Hannibal, Mo., which will also handle A-C diesels.

DODGE announces sales of six C1000 Dodge diesels to Boss-Linco Freight Lines, Buffalo, by Dodge dealer, Great Lakes Motor Corp.

OBSERVED: Two Manitowoc Model 4000 cranes with International diesels, long reach booms, 140 ft. on Dardenelle Dam job of Peter Kiewit and Al Johnson, Minneapolis, in Arkansas.

These three easy-to-get Delco-Remy services mean reduced downtime, faster maintenance by your shop personnel, and peak performance for your fleet vehicles. How do you get these valuable Delco-Remy service helps?

Just ask.

Talk to your local United Motors Service distributor. He'll see that you get the help you need—when you need it! He's also the man to see when you need Delco-Remy original equipment replacement parts. Look over these Delco-Remy services and decide what you need. Then, just ask!

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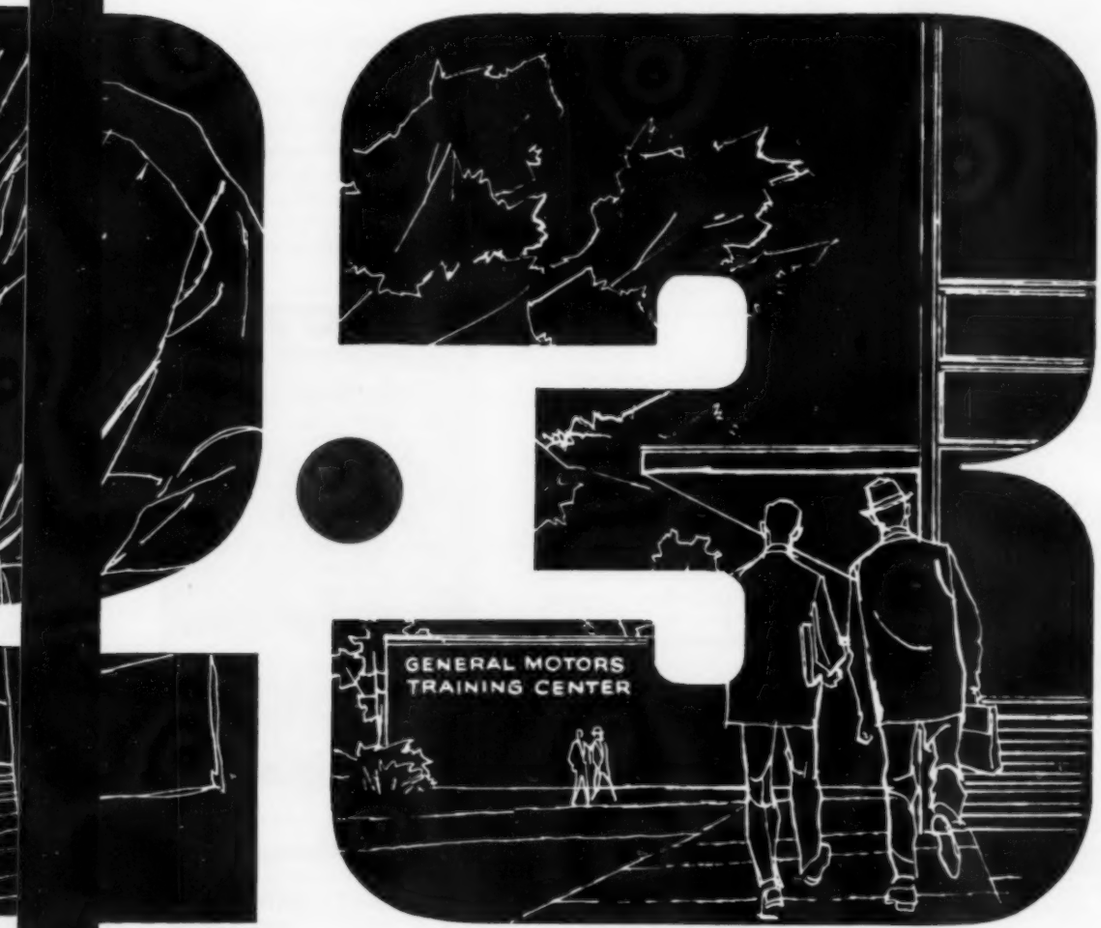

HELP FROM 30 UMS-DELCO-REMY TRAINING SCHOOLS at GM Training Centers that give your service personnel detailed up-to-date information on operation, maintenance and trouble-shooting. The tuition-free courses last for one week and there is no charge for books or class materials.

Florida Diesel News

By Ed Dennis

MIAMI'S Seventh Annual Maritime Day Tugboat Race reached a climax when the newly launched 90 ft. *Edwin N. Belcher*, powered by a pair of GM 12-567 diesel engines, finished one second ahead of its next competitor. In the 50 ft.-and-under class, the 60-year-old *Adele*, powered with a GM 6-71 diesel, won for the fourth consecutive year.

THE St. Petersburg Coast Guard Station took delivery of a new 82 ft. steel hulled patrol vessel. Power develops from a pair of model VT-12M, 600 hp Cummins diesel engines to give this craft a speed of 17 knots.

A study in power and tractability is the model 380 Michigan tractor dozer being used at McCoy Air Force Base on runway construction work by contractor Wiley N. Jackson. It is powered by a turbocharged Cummins NFT-6-BI diesel, rated 375 hp at 2300 rpm, and has a Clark torque converter and transmission

THE *Montego* a 180 ft. West Indies freighter has two GM V6-268A diesel engines with Falk 3:1 r&r gears plus two model 268A GM, 100 kw diesel generating sets for the ship's refrigeration system.

MAIN source of electrical power at the Banana Supply Co.'s plant in Miami is a 125 hp Worthington diesel with a Westinghouse 85 kw, 240 volt, 205 amp generator plus two smaller Worthington dieselized units. Between 30 and 40 thousand stems of bananas are processed at this plant each month.

SHELLEY Tractor & Equipment Co. supplied the two model HA3 Lister Blacktsone diesels, each rated 44 hp at 1800 rpm, for water pumping operations at Cutler Ridge Construction Co.

FORT Lauderdale, Ellis Diesel Sales & Service shipped two GM 6-71 diesel engines with Twin Disc 2:1 r&r gears to Holland to supply power for two Schottel Navigator outboard units to be used by the Baccardi Co. in Recife, Brazil, on barges.

NEAR Sabastian, two Allis Chalmers tractors (HD-19, HD-20) are being used to pull a 30,400 lb. 800 ft. chain on a land clearing job for a citrus grove. Each of the links is a foot long and weighs 40 lbs. Several other Allis Chalmers dieselized units are also being used in other types of work on this operation.

THE 55 ft. *Albatross* had a 5 kw American Marc dieselized generating unit installed for supplying power to the ship's air conditioning system, at Fort Lauderdale.

THE Taylor Sand Co. of Jackson City, Ga., received a model OM 326 Mercedes Benz diesel to be used to supply power for an eight inch sand pump on a barge; the diesel is rated 175 hp at 2000 rpm.

THE Belcher Oil Co. has a GM 4-71 diesel and Falk r&r gears plus a GM power take-off to supply power for a Blackmere eight in. pump for Bunker C fuel oil on Barge #7 and a 6-71 to drive a B. J. Warner pump on their #17, a 92,000 barrel gasoline barge.

THE 134 ft. *El Amigo* powered by a pair of General Motors 8-268-A diesel engines and Snow Nabstedt r&r gears left Miami for Grand Cayman Island where she will start carrying cargo interisland.

FROM Simplex Sales, Hialeah, for a navy installation at Sabena Seca, Puerto Rico, two model NKDBSU (6 ACTV) Waukesha dieselized generating sets.

A Caterpillar model D320 40 kw generating set was supplied by Shelley Tractor & Equipment Co. for installation in a portable concrete plant of the Jamaica Pre-Mix Ltd., Kingston, Jamaica.

REPOWERED from gasoline to diesel, a #330 White highway tractor, by Cummins Diesel Sales, Hialeah, with a model C-160 Cummins diesel rated 160 hp at 2500 rpm using the original transmission, for Motor Leasing of Miami.

INSTALLED in perimeter ditches on the Sottile groves near Sabastian, are two 60 in., 90,000 gpm Couch turbine (Lo-lift) water pumps. Each is powered by twin six cylinder General Motors diesel engines of the 71 series.

FLORIDA Georgia Tractor Co., Miami, supplied the 34 yd. model 295 payscraper being used by Alonzo Cathron on road construction. The unit is powered by a 375 hp DT 817 International Harvester diesel engine.

INDIAN River Farm Supply Co. received from the Miami Br. Detroit Diesel Div. a model 4-71 (131 hp at 2100 rpm) diesel engine for installation in a Speed Sprayer and Naples Redy Mix Co. repowered a dragline with a GM 3030 C (3-71) diesel.

THE Crystal House of Miami Beach had a Hercules powered 50 kw Kohler generating set installed for emergency power. From Simplex Sales of Hialeah.

A Cat powered dredge was shipped to Oran, Algeria by Service Machinery of Hallendale. This portable 40 ton dieselized dredge is currently being used in Oran harbor. A D353 Caterpillar (290 cont. hp) for the 10 in. pump and a D318 Cat (90 cont. hp) for the hydraulic system.

Alco Regional Manager

W. A. Callison, vice president of field sales for Alco Products, Inc., has announced appointment of James L. Layton as regional sales manager for transportation products in the company's Pacific region. Mr. Layton's headquarters will be at San Francisco, Calif. He joined Alco 10 years ago as an engineer.

Harbormaster Marine Tractors give you OUTBOARD MANEUVERABILITY with rugged POWER and ECONOMY

Harbormaster Outboard Propulsion and Steering gives your craft rugged power plus complete 360° maneuverability and the advantages of low cost installation, operation, and maintenance.

Propeller thrust steering permits you to easily dock or maneuver in crowded quarters, stay headed into the current on sharp river bends or in tide rips, run into locks without losing time, shunt or pick up barges with precision, or reverse with full power.

Harbormaster Marine Tractors are easily installed on new or existing craft and are ideal for coastwise service as well as in harbors, lakes, canals, and rivers. The advantages Harbormasters offer in shorter trip times and exceptional maneuverability and versatility have been proved in all types of operations.

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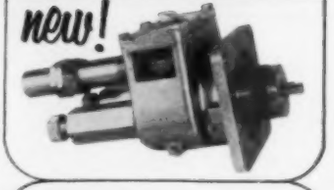

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THERMOSTATS CONTROLS SWITCHES VALVES SAFETY CONTROLS
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ICEI Lube Oil List

The 6th edition of "Lubricating Oils for Industrial and Heavy-duty Automotive Engines" has been released by the Internal Combustion Engine Institute, Chicago, Ill. This pocket-sized booklet lists in its 75 pages the names of approximately 750 oil companies and the brands of their oils which they each guarantee meet the test requirements of U.S. Military Specification MIL-L-2104A and/or British Defence Specification DEF/2101B, as well as the Supplement 1 (S-1) and the Series 3 (Caterpillar) test specifications. Individual copies are available to the interested public at 35 cents per copy in lots of less than 500 per order. For quantities of 500 or more, the price is 30 cents per copy. Requests for the booklet should be made to: Mr. Charles G. Spice, Executive Secretary, Internal Combustion Engine Institute, Room 914, 201 N. Wells St., Chicago 6, Ill.

ITS NEW

Exhaust Purifier Bulletin

Case histories showing different applications for catalyst exhaust purifiers are described in a new four-page booklet. The booklet features 11 problem-solution case histories of typical Oxy-Catalyst exhaust purifier installations on industrial vehicles. It describes how in each incident carbon monoxide, cancer suspect hydrocarbons and other exhaust fume problems were solved by the use of exhaust purifiers. This booklet entitled, "Clean Up Your Exhaust Fumes with Oxy-Catalyst Exhaust Purifiers," is available from the Automotive Division, Oxy-Catalyst, Inc., Berwyn, Penna.

ITS NEW

Garrett Marks 25th Year

The Garrett Corporation of Los Angeles celebrated its Silver Anniversary recently. Founded on May 21, 1936, with a handful of personnel headed by J. C. Garrett who is still president, the organization today is composed of eight divisions and two subsidiaries, employing 10,000 people in operations which span the world. Approximately 5,500 are employed in Los Angeles. Originally formed to provide procurement and engineering services for the embryonic West Coast aircraft industry, the company since then has become a leading developer and manufacturer of environmental control systems for aircraft, missiles and space ships. Practically every American built transport airplane and a preponderance of military planes now carry Garrett pressurization and air conditioning equipment plus numerous other components. The company's sales last year totalled $223,825,000 compared with $284,832 the year it started. In addition to its primary role in the area of environmental controls which are built by its two AiResearch Manufacturing Divisions in Los Angeles and Phoenix, The Garrett Corp. also operates in several other directions. Its AiResearch Industrial Division is a leading manufacturer of power boosting turbochargers for diesel engines. The company continues to expand its manufacturing facilities. Its AiResearch Division in Los Angeles this year opened a new 235,000 square foot manufacturing facility in Torrance, Calif. on 66 acres. In Phoenix an additional 60,000 square foot office-factory building was acquired on 24 acres adjacent to the AiResearch Division of Arizona. It was the second large plant acquisition in Phoenix in two years.

AVAILABLE NOW! The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 9110 Sunset Blvd., Los Angeles 46, Calif.

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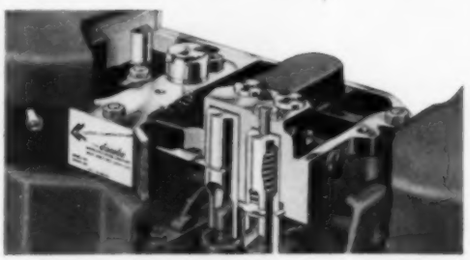

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- Less fuel consumption—increased oil life.
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NEW JACOBS
DIESEL ENGINE BRAKE

. . . one of the great over-the-road economy advancements

The Jacobs Engine Brake gives any diesel transport complete and separate braking *independent of existing brakes.* It converts the engine into an air pump which makes use of every ounce of braking power that a diesel engine can produce, with no heat dissipation problems. In short, the Jacobs Engine Brake converts the diesel into a 100% workhorse that can pull its load uphill *and hold it back going downhill!*

Your driver can easily employ the Jacobs Engine Brake without changing his driving habits. Simple controls are located right in the vehicle cab. Best of all, the brake can be installed on standard diesels, 2-cycle engines, and supercharged or turbo-charged engines. At trade-in time, you can shift the brake easily from one truck to another. Or you can put it on leased vehicles.

CLESSIE L. CUMMINS DIVISION
diesel products
THE Jacobs MANUFACTURING COMPANY
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Gulf Coast Diesel Notes

By Elton Sterrett

W. R. Sims, Pearland, Tex., has purchased from Stewart & Stevenson Services, Inc., Houston, a GM Diesel model 5034-7101-353 power unit which he has installed as repower in a Yumbo hydraulic ditching unit.

J. D. Nicholson Company, Houston, purchased a model VLRDBSU Waukesha diesel from Waukesha Sales & Service, Inc., Houston, which he direct-connected to a 500 kw, 1200 rpm Marathon generator to provide emergency power for Veterans' Hospital of Houston.

TRANS-Canada Airlines, Montreal, Que., has obtained a Stewart & Stevenson model SPGD-475 self-propelled ground power unit for 400 cycle, 90 kva current for plane service. It is powered with a General Motors model 4-71 diesel.

NUECES County Commissioners, Corpus Christi, Tex., have bought from Stewart & Stevenson Services, Inc., a matched pair of GM diesels, model 6-71, equipped with 3:1 r&r gear, with keel cooling and air starting for the ferry boat "Ruby."

NATHAN Clark, Corpus Christi, Tex., will power his 65x25 ft. party boat with two Caterpillar model D333, 6 cylinder, turbocharged and aftercooled diesels, rated 270 hp at 2200 rpm. They will drive through Twin Disc 2:1 r&r gears. The diesels were secured from Zagst, Inc., of Houston.

LOOMIS Hydraulic Testing Co., Pasadena, Tex., will power a testing unit with a General Motors model 5024-7101 series 53, 2 cylinder diesel unit, obtained from Stewart & Stevenson Services, Inc.

THE Commandant Marine Corps, Marine Corps Headquarters, Washington, D.C. has taken delivery from Stewart & Stevenson Services, Inc., of 40 trailer-mounted 45 kw 400 cycle A.C. generator sets, each powered by a General Motors series 71, 3-cylinder diesel.

ST. Mary's Iron Works, Franklin, La., has taken delivery from Waukesha Sales & Service, Inc., of a model VLROBU Waukesha driving a 400 kw 900 rpm generator set for plant power.

SCHAEFER Shows, San Antonio, Tex., has secured a Stewart & Stevenson 125 kva generator set powered by a series 110 General Motors diesel.

DRILLING Accessory & Manufacturing Co., Dallas, Tex., has bought from Stewart & Stevenson Services, Inc., two model 3031-C, series 71, 3-cylinder closed type power units. The General Motors diesels will be used as auxiliary power units on the company's rigs.

PRODUCTION Division, Tenneco Company, Lisbon, La., has obtained from Zagst, Inc., Houston, a model G342 Caterpillar engine, rated 235 hp, which will power a water injection pump.

CENTRAL Texas Bus Lines, Waco, Tex., is repowering one of its buses with a GM model 4-53 diesel, furnished by Stewart & Stevenson Services, Inc.

CANADIAN Pacific Air Lines, Ltd., Vancouver, B.C., has purchased a Stewart & Stevenson model TMGD-460-CPA-61-13 trailer mounted ground support unit generating 60 KVA at 400 cycles. The unit is powered by a model 4-53 General Motors diesel.

MEMORIAL Hospital, Lake Charles, La., is installing a 200 kw engine generator unit for emergency power. Prime mover on the unit is a model V-85 Climax engine, 1200 rpm, furnished by Waukesha Sales & Service, Inc., of Houston.

JAMES J. Fells, Jr., Port Neches, Tex., is repowering a truck with a GM model 4030-C, series 53, 4-cylinder diesel. The unit was supplied by Stewart & Stevenson Services, Inc., of Houston.

GULF Bitulithic Co., Houston, has bought from Pearce Equipment Co., Inc., Houston, two Michigan scrapers, model 210, each powered with a Cummins model NTO-6-131 diesel.

DODGEN Engineering Co., Houston, has taken delivery on a model 4030-C General Motors diesel, equipped with a model C-R-T 333 Allison transmission. The unitizing and sale were by Stewart & Stevenson Services, Inc.

AUSTIN Bridge Co., Houston, has bought from Pearce Equipment Co., Inc., Houston, a model 535 P&H 35-ton crawler crane, powered with a P&H model 487C-18 ET diesel.

HALEY Transport, El Dorado, Tex., has had Stewart & Stevenson Services, Inc., repower an I-H 220 truck with a General Motors 6D-71 diesel.

TEXAS Gulf Sulphur Co., Newgulf, Tex., has taken delivery from Pearce Equipment Co., Inc., Houston, of two model 275-A Michigan 4½-yard loaders, each powered with GM 8V-71 diesels. One unit will go to Newgulf, the other to the company's Beaumont operation.

Form Indian Unit

Massey-Ferguson Ltd., has formed a new company to manufacture diesel tractors in India, the Toronto-based firm announced. The new company, Tractors and Farm Equipment Private Ltd., in which Massey-Ferguson will retain a substantial minority interest, will build a plant near Madras with a single-shift capacity of 3,500 tractors annually. The first model to be produced will be a medium horsepower tractor (the M-F 35) also manufactured in Detroit and widely used in the United States. Sixteen thousand tractors of this model are already in operation in India according to the company.

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for 30 years
to REDUCE maintenance, operating costs and extend engine life

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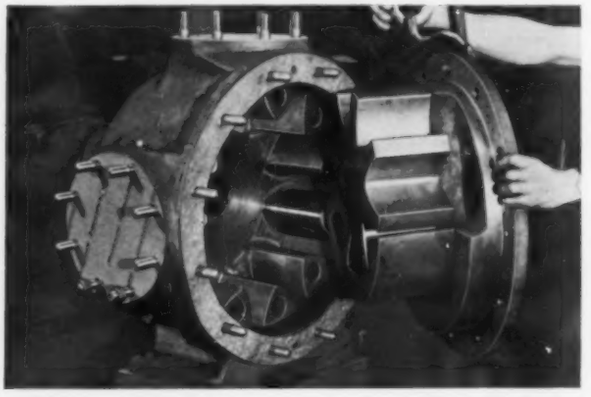

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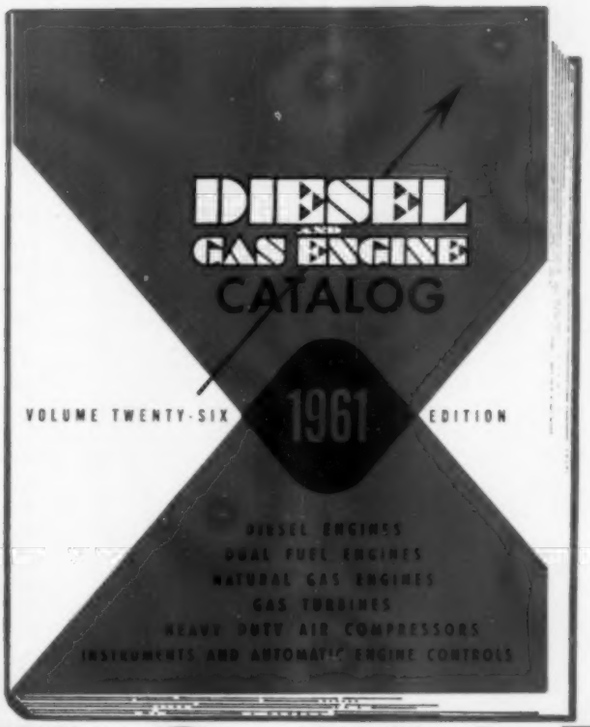

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4. ACCESSORY EQUIPMENT—Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.

5. AIR/GAS HEAVY DUTY COMPRESSORS—This section deals with heavy duty compressors of all types applicable to all industry and petroleum services.

6. INSTRUMENTS and AUTOMATIC ENGINE CONTROL—This section covers just what the title states.

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NAME POSITION

COMPANY

BUSINESS CLASSIFICATION

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U. S. Air Force photo.

Throughout our nation's system of missile bases, diesel engines equipped with Elliott turbochargers drive the generators that produce electric power for the launching sites. By increasing the power output of the diesel engines, Elliott turbochargers permit the use of smaller engines.

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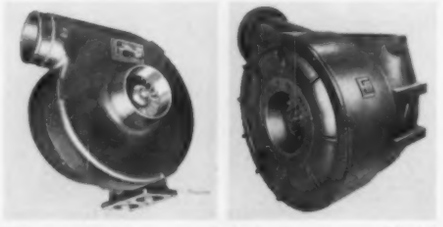

Elliott turbochargers are built in three types: Model M (left, above) for high speed engines; Model H, the high pressure design; and Model L for lower pressures. The latter two are similar in appearance (right, above). All three are simple and sturdy in construction, and precision-built. They serve the entire field of turbocharged diesel engines, 2 cycle or 4 cycle, from 160 to 6000 hp.

MI-1

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Wisconsin Engineers Cite Young

F. M. Young

Fred M. Young, president and founder of Young Radiator Co., Racine, Wis., is among five men widely known in engineering and industrial circles, cited for outstanding accomplishment in their fields, at the 13th Annual Wisconsin Engineers' Day celebration May 5. The engineering and industrial leaders were recommended for Distinguished Service Citations by the University of Wisconsin College of Engineering faculty and President Conrad A. Elvehjem. Citations were presented at the 13th Annual Engineers' Day dinner with more than 400 engineers and industrialists in attendance. The company which Young organized in 1927 to develop and build special heavy duty tube and fin type radiators is today one of the leaders in the heat transfer industry. Mr. Young began his career at the time of the development of the tube and fin type radiator for automobiles. Before he was 21, he was considered an authority on automobile and airplane radiators having furnished them to Fred Duesenberg of racing car fame and Glenn L. Martin, the early endurance flier. In 1917, Young's career was interrupted when he joined the U. S. Air Corps. He was selected for the school of Military Engineering at Massachusetts Institute of Technology, from which he graduated as a lieutenant in 1918. He saw service overseas as an aeronautical engineer and flier. In 1919, upon his discharge from active service with the military, Young was employed by a radiator company in Racine, Wis., as a sales engineer. In 1923 Young and an associate purchased the assets of this company and organized the Racine Radiator Co. He was associated with this company until 1927 when he sold his holdings and formed his present firm, the Young Radiator Company. Mr. Young holds many U. S. patents which are derivatives of his thinking and his efforts, in designing and building equipment for radiators, trucks, tractors, cars, and special devices in such fields as atomic energy, submarines, shipboard, electronics, power units, and gasoline and diesel engines.

International Division Manager

Howard L. Phillips

Appointment of Howard L. Phillips as manager, International Division is announced by Robert E. Friend, president, Nordberg Mfg. Co. Milwaukee, Wis. Mr. Phillips succeeds Mr. B. T. Eagerton, who is retiring after 15 years with the company. Mr. Phillips will be responsible for all functions of the export sales department and for the administration of overseas branches, foreign manufacture and license agreements. He was formerly export sales manager, and assistant export manager. He joined Nordberg in 1947 with experience in the export field in administrative, engineering and sales capacities including eight years as a sales representative in the Far East.

Carlson Heads Allis-Chalmers Engine—Materials Handling Division

J. W. Carlson

John W. Carlson has been appointed general manager of the Allis-Chalmers Mfg. Co. Engine-Material Handling Division. He had been assistant general manager of the Company's Construction Machinery division and succeeds L. C. Daniels. Mr. Carlson joined Allis-Chalmers in 1938 following graduation from the University of Idaho with a bachelor of science degree in Mechanical Engineering. In 1946 he joined the Tractomotive Corp., Deerfield (Ill.), as a design engineer. He was appointed general manager in 1952 and two years he was elected president of that company. When Allis-Chalmers acquired Tractomotive in 1959, he continued as general manager of the Deerfield Works. Mr. Daniels has been general manager of the Engine-Material Handling Division since 1957 and continues with Allis-Chalmers in an advisory capacity. He joined the Company in 1953 when it acquired the Buda Company of Harvey (Ill.) where he had been a vice president since 1950.

Tug *El-Jean*

Gladding-Hearn Shipbuilding Corporation has delivered the welded steel 51 ft. 3 in. x 15 ft. 3 in. x 7 ft. 6 in. draft tug *El-Jean* to the Monahan Towing Co., a subsidiary of the Liberty Concrete Corp. of Philadelphia. The boat is designed for towing sand and gravel barges on the Delaware River and is a modification of the *Morania No. 4* built for McCormick Sand and Gravel three years ago. The *El-Jean* will replace the wooden tug *Evening Star*. Power is supplied by a General Motors tandem 6-110 unit providing 440 hp for continuous duty at 1800 rpm. The engine is fitted with a 5:1 reduction gear and turns a 64 in. x 46 in. three-blade Federal propeller. The tailshaft is 4½ in. diameter Tempaloy 917, selected because of its high strength to weight ratio. The American Brass Co., manufacturers of Tempaloy 917, stated that this was the largest shaft of the material made to date and signified a break-through in their production capacity of this new material. The engines are keel-cooled through channels welded to the hull exterior and each engine was fitted with a separate cooling system. Each engine can be operated to drive the vessel independently or as a unit. A free running speed of 10.5 knots was obtained with full power and about 7 knots with one engine.

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SF 213 – Shown above, center, the lightweight single wire braid, fabric covered hose assembly designed for hot engine oil and fuel lines and many other applications. Withstands temperatures from –40°F to 300°F.

SF 224 – Shown above, right, the high temperature stainless steel wire braid covered Teflon hose assembly, designed for chemicals, petroleum or synthetic base lubricants, acids, solvents, steam service and hot asphalt lines. Withstands temperatures from –65°F to 450°F.

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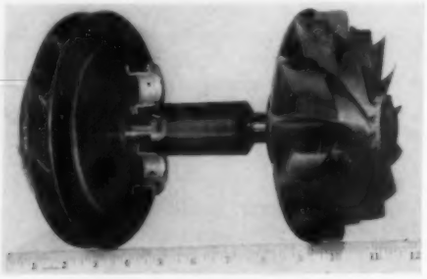
Turbochargers In Good Shape After 30,000 Hours Of Operation

A pair of turbochargers have been found trouble-free following an impressive tenure of 30,000 hours continuous operation of a Clark Bros. natural gas engine compressor. The model T3011 units, removed from the engine for inspection, were developed and produced by The Garrett Corp.'s AiResearch Industrial Division. They have been in operation for Richfield Oil Corp. at its South Cuyama and Fillmore (Calif.) facilities for three and one-half years. They provided an average power boost of 30 to 40 per cent for a Clark model Ma-8 compressor unit, giving it an output range of 360-400 bhp at 600 rpm. The turbochargers themselves operated at 28,000-32,000 rpm.



Complete rotating assembly with compressor bearing shows little effect from extended service. Ruler indicates relatively small size of turbocharger.

Back in April 1957, these air-cooled turbochargers were the first installed in a project which later proved to be extensive and was concluded this year with 135 AiResearch turbochargers in round-the-clock operation on a number of Clark engine models. They are providing the Richfield facilities with a total gain of approximately 9,000 hp in pumping natural gas from wells and plants. The two turbochargers received no maintenance and were responsible for reduced maintenance requirements on the engine. However, it is vitally important that Richfield provided for a constant, clean oil supply under adequate pressure. Engine oil is supplied to the T3011s by the main engine oil pump at 35 psi, with an air operated prelube pump used prior to starting. Full flow, 5 micron filters are used. Inspection of the two long-service turbochargers showed no significant wear on the bearings and journals.

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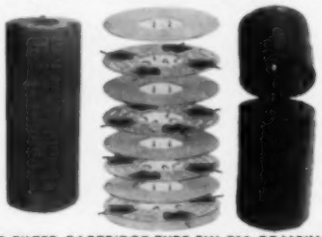

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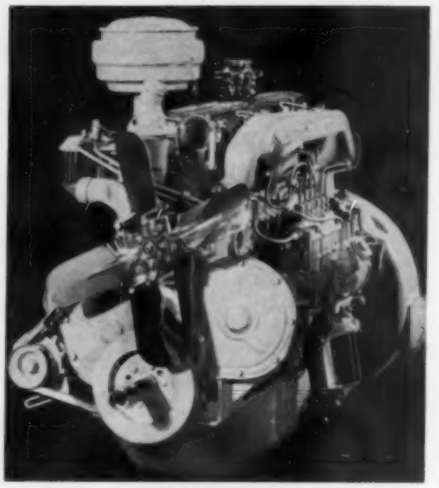
GM Will Distribute Bedford Engines in Canada

The GM Bedford diesel, is being distributed in Canada by General Motors Diesel Limited, London, Ont. The company previewed the two models of Bedford diesel engines at Toronto, Montreal and Vancouver General Motors Motoramas in recent months. Bedford Diesels are manufactured in England by Vauxhall Motors Limited. These engines have been installed in over 50,000 Bedford trucks and commercial vehicles operating all over the world. The engines are the Bedford 200 and the Bedford 300. The former is a 4-cylinder unit with a displacement of 200 cu. in. while the latter engine is a 6-cylinder unit with a displacement of 300 cu. in. Both engines are in-line units with aluminum pistons, heavy duty forged crankshafts, slip-fit dry cylinder liners and overhead valves. The engines operate on the 4-cycle principle using the C.A.V. fuel injection system. Both are built to the same basic design with a high degree of parts interchangeability. The Bedford 200 is rated at 57 bhp at 2600 rpm, automotive rating, and 54 bhp at 2400 rpm, industrial rating. Continuous rating is 49.5 bhp at 2400 rpm. It weighs 830 lbs.; is 35.5 in. long, 24.5 in. wide and 36.5 in. high. The Bedford 300 is rated at 89 bhp at 2600 rpm, automotive rating, and 82.5 bhp at 2400 rpm, industrial rating. Continuous rating is 75 bhp at 2400 rpm. Its weight is 1,010 lbs. It is 45 in. long, 24.5 in. wide and 38 in. high. Continuous marine rating for work boat applications where full load operation is expected over extended periods is 47 bhp for the Bedford 200 and 71.5 bhp for the Bedford 300, both at 2200 rpm. Intermittent ratings are 55.5 and 85 bhp at 2400 rpm for the Models 200 and 300, respectively.



GM Bedford 300 diesel.

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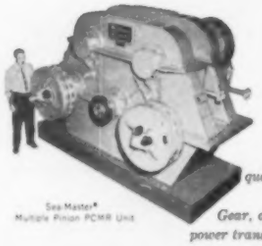

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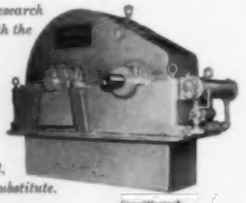

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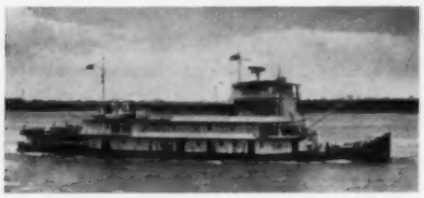
Allis-Chalmers Tractor Loader

Allis-Chalmers has expanded its line of tractor loaders to six models with the introduction of the new TL-30. This four wheel drive unit becomes the biggest in Allis-Chalmers line of tractor loaders, featuring a 10,500 lb. carrying capacity and a maximum lifting capacity of 25,000 lbs. The new tractor loader is powered by Allis-Chalmers turbocharged model 11000 diesel engine with a rating of 184 hp at 2,200 rpm. A single lever permits power shifting on the go at any speed and in either forward or reverse. Allis-Chalmers points out that single lever shifting lets the operator easily move into a stockpile and instantly drop into low crowding speed for full-capacity loading and reverse direction instantly. The TL-30 also features a maximum dumping clearance of 10 ft., four and one-half in. and a 37 and one-half in. reach forward from the tires for center loading of high, wide truck bodies.

As on other models of Allis-Chalmers tractor loaders, axles on the TL-30 are pin-connected directly to the frame with two inch diameter steel pins rather than automotive-type U-bolt connections. Among the attachments and accessories available for the new tractor loader are special buckets, lift fork, backfiller blade, bucket teeth, and log tongs.

Mississippi In Service

The diesel towboat *Mississippi* which went into service April 19, 1961, while by no means the most powerful on the river, is one of the most modern in design and equipment. With controllable and reversible pitch propellers, it is uniquely equipped for such widely varied duties as moving heavy tows along the waterways and serving as a fast moving inspection vessel when so needed. (See DIESEL AND GAS ENGINE PROGRESS, January, 1961)



Externally, the new boat bears little resemblance to her namesake-predecessor. Missing is the giant stern paddle wheel which was the *Mississippi* trademark for a generation. Also absent are the tall twin smokestacks which were reminiscent of the packet boats of a century ago. And finally, the new boat has none of the traditional packet boat cabins and decks which distinguished the older boat. None of which should indicate that the new *Mississippi* does not have its own modern style of beauty. From hull to pilothouse, it presents an appearance of grace and symmetry, the result of the most painstaking and thorough studies and experimentation to produce maximum efficiency. The design of the hull resulted from extensive performance tests conducted in the internationally famous Netherlands Towing Tank at Wageningen, Holland. The new towboat is required to operate under a wide range of conditions. As a towboat it is designed and powered to push a tow of not less than 15,000 gross tons, consisting of 24 barges, at a still-water speed of not less than eight miles per hour; without tow it will attain a speed of fifteen mph. Due to the propeller design, a maximum reverse thrust of not less than seventy per cent of that in forward direction is produced. Driving the controllable-reversible propellers are two Nordberg 8-cylinder diesel engines, each developing 1,860 hp. Complete engine controls are located in both the pilothouse and engine room. The public hearing room, utilized by the Mississippi River Commission on their twice-yearly trips along the river, are on the second deck, in the same relative position as on the old Steamer *Mississippi*.

Tractor Dozer Engine Options

Two new horsepower-increasing engine options for the Michigan model 380 (series II) tractor dozer are announced by the Construction Machinery Division of Clark Equipment Co. First of the optional new engines is the General Motors Model 12V-71, a 430 hp diesel. It is a 12 cylinder, two-cycle diesel with 851.2 cu. in. displacement. and produces a maximum of 1210 ft. lbs. of torque at 1200 rpm. Previously a 375 hp diesel engine was used in this machine. The other new power plant is the Cummins model NVH, a 12 cylinder diesel rated at 450 hp. It is a four-cycle engine with 1486 cu. in. displacement, and produces 1232 ft. lbs. of torque at 1500 rpm. Both units have 24 volt electrical system. Driven through the Clark power train, the new model 380 (series II) has a top speed of 28.6 mph in forward or reverse. The drive line consists of a construction machinery type 3 to 1 multiplication factor torque converter, four-speed power shift, and all-wheel drive. Equipped with the new GM diesel and the large 33.5-33 tires, the tractor dozer now weighs (approx.) 81,400 lbs. With the Cummins engine and the same tires, the model 380 weighs (approx.) 85,400 lbs. For further information write the Construction Machinery Division, Clark Equipment Co., Pipestone Plant, Benton Harbor, Mich. (ITS NEW)

Ruston U.S. Importer

Stanley International, San Francisco, has announced conclusion of an agreement with Ruston & Hornsby, Ltd., English diesel engine manufacturer, whereby Stanley will act as direct importer for Ruston's air-cooled YDA engines in 11 Western states, Alaska and Hawaii. The YDA series diesel engines are adaptable to many types of service. Features are : low weight/power ratio; no cooling problems (operate at –40° to 125° ambient temperature without special attention) ; maximum interchange of parts, one bore and stroke size from 29 hp to 110 hp, individual cylinders and patented design head assembly requiring no head gasket; standard bolt threads and SAE flywheel housings; wide range of accessories for creating many desired configurations. Full power is available from either end. The engines are available in 2, 3, 4, and 6 cylinder models developing from 29-87 cont. bhp at 1800 rpm. Automotive versions develop up to 110 hp at 2,200 rpm.

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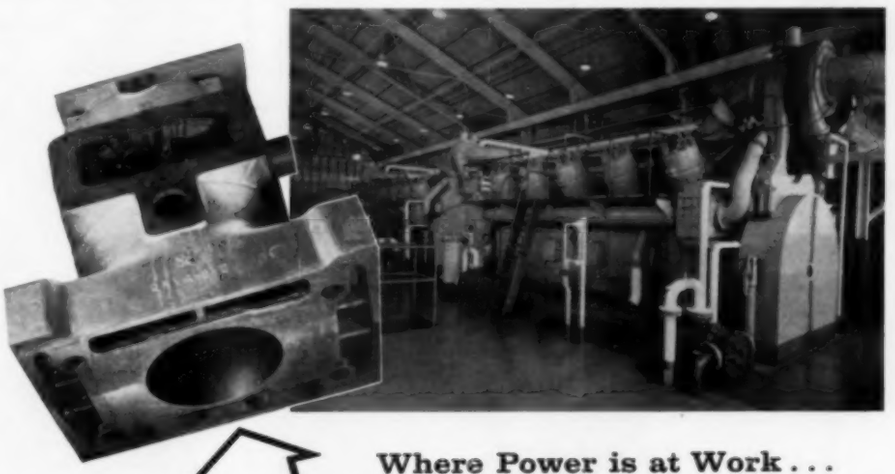

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Inland River Reports

By A. D. Burroughs

FAIRBANKS-Morse pushpower rates the rivermen's recognition with the outstanding power performance turned in by Ohio River Company's new towboats, *John Ladd Dean*, and the powerful *Orco*. Both vessels are handling record-size tows, pushed with the 4000 hp developed from the Fairbanks-Morse diesels equipping each boat.

GEORGE Engine Co., New Orleans, furnished the three tandem V8A-71 GM's powering the new 96 ft. cruiser, *Pecten*. The newest addition to the Caspary and Wendell fleet, Rockport, Tex., the cruiser was completed by Burton Shipyard, Port Arthur, Tex.

A special thanks to Walt Gennette, Taylor Machinery Co., Memphis, Tenn., for news of the sale of the Caterpillar D343 series A turbocharged-aftercooled diesel marine engine now supplying a rated 300 hp for the *M/V Sam R.* The craft is operated by McAllister Construction Co., Memphis.

MARIE S. Moran and *Margaret Moran*, two new tugs completed by Dravo, are in service for Moran Towing and Transportation Co., N.Y. The 101 x 27 ft. tugs have a rated 1600 hp each, developed from GM engines.

TWIN Caterpillar engines, model D 353, furnished by Whayne Supply Co., Louisville, equip the new *Franklin B.* Built by Yates Marine Construction Co., Wheeling, W. Va., for Merdie Boggs and Sons, Inc., Ashland, Ky., the 58x19 ft. towboat has a rated 760 hp.

A new tug, *Black Sheep*, is in service for Mouton's Towing Service, Lake Charles, La. The 45x18 ft. craft is powered with twin GM engines furnished by Stewart and Stevenson, Inc., Houston.

A new triple-screw towboat is getting final inspection rounds at Costa Co. yards (Omaha). Designed by A. M. Deering firm, the 65x25 ft. vessel will have a rated 900 hp supplied from three Caterpillar engines.

BIG boats were active on inland waters with the 120 ft. *Double D.* spotted on the lower Mississippi. Serving Central Soya Company, power rated at 3200 hp comes from two GM (Cleveland) engines.

THE ultra-modern *Mississippi*, fourth U.S. boat of the name serving the Corp of Engineers, was spotted in action making good time with the rated 4000 hp developed from two Nordberg engines.

CURRENT power-king, the 9000 hp *America* was sighted in service for Federal Barge Lines. Four Cooper-Bessemer engines provide the pushpower for this towboat, rated as the world's most powerful inland river craft.

Heat Recovery Silencers

Engineering Controls, Inc., has announced a new line of heat recovery silencers suitable for all types of internal combustion engines. The silencers are described in a new four page brochure issued by the firm. The new line is available in a wide range of corrosion resistant coatings for both interior and exterior applications. The standard exterior coating is a high heat resistant metallic coating which becomes an integral part of the metal on application of heat. A portion of the brochure is also devoted to an outline of Vapor Phase heat recovery and silencing, also produced by Engineering Controls. For a copy of the brochure write Engineering Controls, Inc., 611 E. Marceau, St. Louis 11, Mo. (ITS NEW)

ESB Marketing Unit

A new sales and service organization—the Exide Industrial Marketing Division—has been created by The Electric Storage Battery Co. to serve as the marketing arm for its Exide Industrial Division and its new Nickel-Alkaline Division. It combines into one unit the Exide industrial sales and service engineering facilities with those of the former Edison Storage Battery Division of Thomas A. Edison Industries, McGraw-Edison Company, now called the Nickel-Alkaline Division which was purchased from Edison by ESB last August. The new marketing organization is headed by Exide's vice president-marketing, C. J. Moore. It now offers a line of batteries, charging equipment and related components as well as comprehensive service engineering facilities.

ICEI Officers Elected

New officers of the Internal Combustion Engine Institute elected recently are President: C. E. Nelson, Jr.—Waukesha Motors Co.; Vice President: Phil Norton—Wisconsin Motor Corp.; Secretary: David W. Onan II—ONAN Division of Studebaker-Packard Corp.; Treasurer: E. V. Oehler—Briggs & Stratton Corp.; Director: G. Waine Thomas—Continental Motors Corp.; and Executive Secretary: Charles G. Spice.

50,000 PSI Casting Tensiles

Fifty thousand psi casting tensiles on standard aluminum alloys are being approached by Precision Metalsmiths, Inc., Cleveland, Ohio, producers of investment castings. 355 standard aluminum alloy is being investment cast and in the T7 condition gives an ultimate tensile of 49,500 psi with a 3 per cent elongation per 1 in. gage length. Typical tensile is 45,000 psi with a 4 per cent elongation. 356 standard aluminum alloy is being investment cast and in the T6 condition gives an ultimate tensile of 44,000 psi with an 8½ per cent elongation per 1 in. gage length. Typical tensile is 40,000 psi with a 5 per cent elongation. Consistent cast results are obtained through foundry techniques developed by Precision Metalsmiths and include: hollow sprue gating technique and a ceramic shell, double degassing of aluminum melt, vacuum assist casting technique and elimination of metal turbulance during pouring of mold.

starting power . . .

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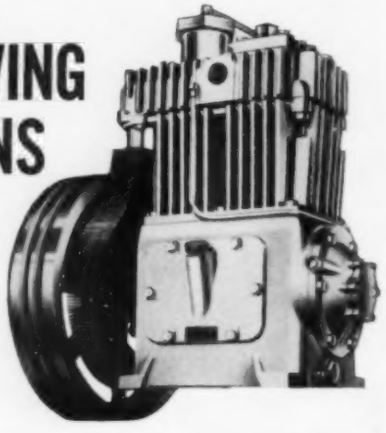

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When oil or control pressure drops below set level, Amot Model 1476 automatically trips and shuts down engine using positive snap-action principle. Tripping pressure adjustable from 5 to 30 p.s.i. For solid fuel or gas engines. Used with other safety devices for complete protection. Compact, non-electrical.

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Michigan-Ohio News

By **Jim Brown**

CUMMINS Diesel Michigan Inc. of Dearborn, Mich. reports installation of a Cummins Model NH-250-B in a Mack B-71 tandem truck for Ben T. Fyke & Sons, Inc. of Berkley, Mich.

EHRINGER Brothers of West Branch, Mich. has purchased a new Allis-Chalmers model HD6E bulldozer with hydraulic dozer blade. Sale was made by Earle Equipment Co. of Detroit.

WOLVERINE Tractor & Equipment Co. of Detroit and Grand Rapids delivered a Hough H-120 Payloader to Jennings, Inc. of Fenton, Mich. The new Hough is powered by a Cummins engine and will be used to stockpile gravel and load trucks. The H-120 is the largest of the Hough line, weighing 45,000 lbs.

CHRYSLER-Perkins Engine Division reports that Checker Cab Co. of Detroit recently ordered six 1961 Plymouth cabs equipped with Chrysler-Perkins P/203 diesel engines.

THOMAS Sinacola Contracting Co. of Livonia, Mich. has accepted delivery on a Case model 800 crawler with front-end loader. The new Case is powered by a Continental HD277 diesel and was purchased from J. R. Panelli Equipment Co. of Southfield, Michigan.

CYRIL J. Burke, Inc. of Detroit reports the sale of a Northwest model 95 pullshovel (2½-yd.). The Northwest, powered by a Murphy 21 diesel engine, was purchased by Angelo DiPonio of Detroit.

ANGUS McIntyre of Port Huron, Mich. has accepted delivery on an International TD-9 with a 4-in-1 Drott Skid-Shovel. Sale was made by Wolverine Tractor and Equipment Co.

CONSUMERS Slag Co. of Warren Mich. has accepted delivery on an Allis-Chalmers model TL-14DA Tracto-loader (1½-yd.). The new loader will be used for loading and stockpiling slag and was purchased from Earle Equipment Co.

CUMMINS Diesel Michigan Inc. recently sold a Cummins JN-6-VI diesel engine to Fulton County, Ohio for installation in a Galion T-500 road grader.

VER PLANK'S Spring Lake Coal Co. of Spring Lake, Mich. has accepted delivery on a Hough H-70 Payloader powered by a Cummins engine. Sale was made by Wolverine Tractor & Equipment Co.

FARINO Excavating Co. Inc. of Detroit has accepted delivery on a Northwest model 95 pullshovel (2½-yd.) powered by a Murphy 21 diesel engine. Sale was by Cyril J. Burke Inc.

R. G. Moeller Co. of Detroit sold an Austin-Western Super 100 grader to Ingham County Road Commission. The new grader is powered by a GM 3-71 diesel engine.

A model 520 Link-Belt diesel pile driving hammer was recently sold to the Garavaglia Co. of Detroit for use on the new John Lodge Expressway. Sale was made by Miller Equipment Co. of Livonia, Mich.

RAY Welch, Inc. of Franklin, Michigan has accepted delivery on a Hough H-50 Payloader powered by an IH UD282 diesel engine. Local Hough Distributor is Wolverine Tractor and Equipment Co.

PENINSULAR Diesel Inc. of Detroit reports sale of a 120 kw generating set powered by a 6150 GM diesel engine. The unit was purchased by Ann Arbor Construction Co. and will be used in a gravel plant.

CITY of Midland has accepted delivery on an Austin-Western "Super 100" grader powered by a GM 3-71 diesel engine. Sale was by R. G. Moeller Co.

HURON-Clinton Metropolitan Authorities has accepted delivery on a Case model W-9A 4-wheel drive, front-end loader to be used for maintenance of beaches and parks. The unit was equipped with a Case 301D diesel engine and was purchased from J. R. Panelli Equipment Co.

A new International TD-9 with Drott 4-in-1 Skid-Shovel was recently delivered to Steve Klochko of Dearborn, Michigan. Sale was by Wolverine Tractor and Equipment Co.

CUMMINS Diesel Michigan Inc. recently installed a Cummins NH-195-B in a model 723 Diamond "T" truck for Joseph Filipiak of Goodelle, Mich.

WEISSMAN Excavating Co. of Detroit has accepted delivery on a Northwest 95 pullshovel (2½-yd.) powered by a Murphy model 21 diesel engine. Sale was by Cyril J. Burke, Inc.

THUNDER Bay Gravel Co. of Alpena, Mich. has accepted delivery on a Trojan model 204 tractor shovel (2-yd.) powered by a GM 3-71 diesel. Local Trojan distributor is R. G. Moeller Co.

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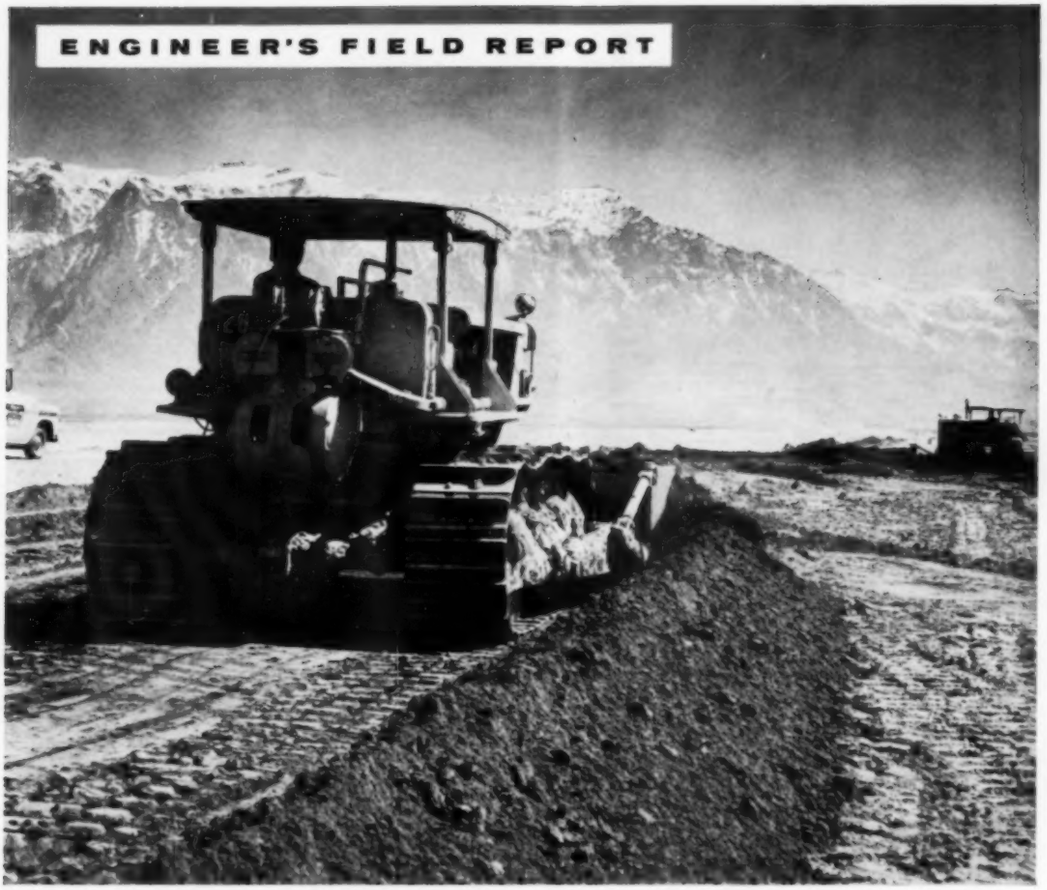

RPM DELO Oil helps move ten million cu. yards of earth fill at Willard Dam

Willard Dam and Reservoir, located near the mud flat shores of the Great Salt Lake, will be enclosed by a 17-mile earth embankment with a maximum height of 35 feet. This giant earth-moving project, under the supervision of the U.S. Bureau of Reclamation, is a real test for equipment . . . and for RPM DELO Oil.

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"We use RPM DELO Oil exclusively in all our diesel and heavy duty gasoline equipment," reports Jim Udall, master mechanic on the project. "Engine parts remain clean and in good condition. We get up to 3500 hours between overhauls on our D-8's, have had no trouble on our Euclid trucks. We've used "RPM DELO" for over three years with excellent results."

RPM DELO Oil reduces wear and prolongs engine life because it clings to parts whether the engine is running or idle . . . hot or cold. Piston rings stay free because an anti-oxidant fights gum and lacquer formation and a special detergent keeps parts clean. Other additives prevent corrosion of bearing metal and crankcase foaming.

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TRADEMARK "RPM DELO" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

M. C. Petersen (right), Power Plant Superintendent, and Robert Twigg, Operating Engineer, in front of one of the new LSV engines. Estherville's Superintendent of Public Works is Russell Peterson. The installation was engineered by Associated Consultants, Minneapolis.

The decision at Estherville:

two thrifty LSV engines

The Cooper-Bessemer LSV-16 supercharged dual-fuel engine shown here is just half the expansion picture from Estherville, Iowa. This and a duplicate 4210 hp, 3000 kw unit with En-Tronic Control are enabling this thriving town of 8000 to meet its kilowatt demands with a thrift that can't be matched.

To support their decision, Estherville officials saw plenty of power plant performance data on the economy of these Cooper-Bessemer engines. Operating records show that LSV's are delivering 20% to 30% more power per fuel dollar than units of conventional design.

When you start to plan new facilities, be sure to investigate Cooper-Bessemer engines. There's a type and size to match your needs. Call our nearest office.

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